EXHIBIT 10

Legal Retention at MSXSOC

From: Stanley CC (Curtis) at MSXWHWTC
Sent: Wednesday, May 13, 1998 11:49 PM
To: Parkinson CD (Chris) at OPC
Cc: Gustafson JB at SHELL RESEARCH THORNTON; Sykes RM at SIEP
Subject: MTBE Issues

Chris,

I'm sorry that it has taken me awhile to get back to you on MTBE issues. I know that you are beginning to feel the heat (it will get much hotter). As you are aware, MTBE is one of the biggest environmental issues that US oil companies are facing due to 1) MTBE's wide occurrence in groundwater, 2) MTBE's high migration potential, 3) MTBE's impact on several high visibility municipal well systems, 4) MTBE's very low odor and taste thresholds, and 5) the difficulty and high cost associated with treating MTBE in water. My first association with MTBE was in 1980 at Rockaway, NJ where 4,000 people were tasting ether (MTBE and DIPE) in their water supplied from a municipal well. The problem in the US in now much worse. I hope that the following information will help put the issue in perspective for you. As you are reviewing this information and have any questions, please feel free to call me.

Cal EPA Brfg 3 98.doc — a very well written and balanced paper from a state perspective

MTBE research table 4-98.doc — This is MTBE research conducted by API's Soil/Groundwater Technical Task Force which I chair

EPA MTBE Proj. list

[illegible]

NW California MTBE Advisory P...

California activities mandated by the legislature

MTBE editorial.doc — This is an editorial that the National Ground Water Association requested that I write for the Association of Ground Water Scientists and Engineers (May/June Issue 1998)

[illegible].doc — This is an API fact sheet from my Task Force

MTBE Natural Persuasive 3.pp... — This is a presentation that I have made to Shell Mgmt

EQ 028732

MTBE Properties.ppt

This is a table that I modified from some of John's work for my editorial

MTBE2.ppt

This is an MTBE remediation presentation that I made to Shell's remediation managers

In addition to the above references, I am in the process of writing two papers on MTBE considerations for RBCA. These papers will be presented 1) next week at the Battelle Conf on Recalcitrant Compounds, and 2) at the NGWA conf on MTBE in LA in June. We are also conducting work with decision analysis tools to help guide our remediation efforts for MTBE.

I'm sure this is much more than you bargained for, but like I said, if you have any questions, I'm only a call away.

Best Regards,

Curtis C. Stanley
Environmental Technology Directorate - Soil and Groundwater
Westhollow Technology Center
(phone-@2) 281-544-7675 (fax-@)) 281-544-8727
e-mail: ccstanley@shellus.com
(This communication per applicable agreements between our respective companies.)

Memorandum

San Francisco, CA
June 11, 1986

MARKETING ENVIRONMENTAL
CONCERNS REGARDING
THE USE OF MTBE IN MOGAS

MR. O. T. BUFFALOW:

We are currently involved in the cleanup of an aquifer in Maryland contaminated by several different company's leaking underground storage tanks. The companies involved, including Gulf, were utilizing MTBE (Methyl Tertiary Butyl Ether), a motor gasoline octane improver. The EPA has shown great interest in the removal of MTBE from this contaminated aquifer. A literature study by the API has shown that MTBE, and the related octane enhancer IPE (Isopropyl Ether), have several disturbing properties. Both MTBE and IPE:

- have relatively high solubilities in water - an order of magnitude higher than BTX (Benzene, Toluene, Xylene)
- have relatively high mobility in the subsurface - will move to the leading edge of a contamination plume
- have low odor and taste thresholds in water
- are relatively stable with respect to biodegradation
- are expensive to remove from water - air stripping is required with follow-up treatment probably necessary to attain the extremely low discharge concentrations likely to be mandated by a governmental agency

We understand that Chevron currently utilizes MTBE at Port Arthur extensively and to a lessor extent in Pascagoula. We further understand that MTBE is anticipated to be used at some other Chevron refineries as the EPA mandated lead-phasedown continues to impact octane requirements. This projected increase in MTBE utilization concerns Marketing for two major reasons:

- MTBE utilization could increase the cost to clean up leaks at service stations and terminals; and
- MTBE could become a significant constitutent of mogas storage water-draws and attact regulatory attention to Marketing terminal effluent. Marketing terminals generally route effluent through a simple API separator and have no facilities to treat or reduce dissolved component contamination.

Please let us know what refineries are currently using MTBE or IPE. Although we expect usage varies with operating necessities at the refineries, please let us know which blends generally utilize MTBE/IPE and at what average concentrations. Please let us know what your future plans are with respect to these additives.

Thank you for your cooperation.

D. W. CALLAHAN

JK:J-2

cc: Mr. R. W. Kreutzen - Please let us know if you are aware of any Chevron NPDES permits with MTBE limits, or expect future regulatory activity in this area.

Circulating File - 2500

êMSG FROM: WH889CCS--VM19 TO: MK59MDM--VM01 07/15/93 07:28:39
To: MK59MDM --VM01

*** Reply to note of 07/14/93 19:23
Curtis C. Stanley
Staff Hydrogeologist - Environmental RD&T
Subject: Bolsa Chica @ Edinger, Huntington Beach

Sounds like you guys are covering the bases as best as you can. We need to convince management to implement dual containment NOW!

Curtis C. Stanley
Staff Hydrogeologist - Environmental RD&T
Profs Nickname: HYDRO1 Location: WRC ET-102
Bell: 493-7675 SSN: 433-7675
ÿÿ□□□□Bolsa Chica @ Edinger, Huntington Beach R□□
êMSG FROM: MK59MDM --VM01 TO: WH889CCS--VM19 07/14/93 19:23:54
To: WH889CCS--VM19

*** Reply to note of 07/14/93 08:32
From: DAN MCGILL, MDM1
Subject: Bolsa Chica @ Edinger, Huntington Beach
The tanks were single wall with single wall lines (two of the lines were also leaking under the dispensers). We need some help out here... this stuff is going to greatly increase the cost of our clean-ups. The one good note is that MTBE is acting as a tracer for leaks - this is the second time that our lab data has indicated that we we having an on going release. Our lab "screens" all of our groundwater samples for MTBE and gives me a call if MTBE shows up some where we have not seen it before.

cc: MK40PJP --VM01 P J PUGNALE

M. DANIEL McGILL
ENVIRONMENTAL ENGINEER
ANAHEIM, CALIFORNIA
SSN 520-3370
ÿÿ□□□ÅBolsa Chica @ Edinger, Huntington Beach R□□
êMSG FROM: WH889CCS--VM19 TO: WH889ALO--VM19 07/15/93 11:22:36
To: WH889ALO--VM19 A L OTERMAT

Curtis C. Stanley
Staff Hydrogeologist - Environmental RD&T
Subject: Tech. Assurance Paragraph for Waste Site Manager's Meeting

Per Environmental RD&T's technical assurance role in Product's, a draft paper describing componenets for achieving technical assurance at waste sites was presented. Copies of this document will be distributed to all waste site managers for comments. A key component for technical assurance is based around waste site technical teams on higher priority sites. These teams will function in much the same way that groundwater teams work at manufacturing locations. Comments will be reviewed at the next Waste Sites Team Meeting and a final document will then be prepared.

Curtis C. Stanley
Staff Hydrogeologist - Environmental RD&T
Profs Nickname: HYDRO1 Location: WRC ET-102
Bell: 493-7675 SSN: 433-7675

Legal Retention at MSXSOC

From: Stanley CC (Curtis) at MSXWHWTC
Sent: Thursday, May 14, 1998 10:25 AM
To: Bell, Kathy; Boschetto, Brad; Broussard, Gweneyette; Chiang, Chen, Chou, Chi-su; Daly, Phil; Darmer, Ken; Dedoes, Robert; Deeley, George; Devault, George; Dinkfeld, Edward; Dorn, Phil; Dove, John; Ettinger, Robert; Farrier, Daniel; Franceschini, Timothy; Gallagher, Michael; Gilmore, Kathleen; Green, Tom; Hansen, Erik; Hastings, Robert; Hong, Marjorie; Hsu, Ed; Ivie, Jerry; Jacobs, Joe; Krewinghaus, Bruce; Lewis, Richard; Lieder, Chuck; Lyons, Karen; Marshall, Glen; Miller, Jim; Miller, Jonathan; Neaville, Chris; Otermat, Art; Pugnale, Pete; Register, Allen; Rhodes, Ileana; Salanitro, Joe; Schroder, Richard; Sepesi, John; SHELTON, CHARLES; Spinelle, John; Spinnler, Gerard; Springer, Ken; Stearns, Steve; Sun, Paul; White, Christine
Cc: Gustafson JB at SHELL RESEARCH THORNTON; Parkinson CD (Chris) at OPC
Subject: FW: MTBE CONTAMINATION

This article highlights the issue around leak detection and backs up our research that extremely small releases can cause groundwater problems. I think that this issue may cause us to reevaluate how we do leak detection in environmentally sensitive areas

Curtis C. Stanley
Environmental Technology Directorate - Soil and Groundwater
Westhollow Technology Center
(phone-☺) 281-544-7675 (fax-☹)) 281-544-8727
e-mail: ccstanley@shellus.com
(This communication per applicable agreements between our respective companies.)

-----Original Message-----
From: Judy Shaw [SMTP:shaw@api.org] <mailto:[SMTP:shaw@api.org]>
Sent: Thursday, May 14, 1998 7:55 AM
To: Al Jessel; Brian Harney; Carol Fairbrother; Curt Stanley; Dave Peirce; David Smith; Don Gilson; Eric Vogt; Gene Mancini; Georgia Callahan; Gerry Raabe; Gweneyette Broussard; James Rocco; Jeff Sickenger; Jim Ford; Jim Stevenson; John Taunton; Lee Hoffman; Mark Saperstein; Mary Kate Kell; Mike Wang; Ned Seppi; Ron Benton; Tim Buscheck; William Doyle
Cc: Alexis Steen; Bill Bush; Bill Frick; Bob Greco; bruce bauman; Carol Henry; Chuck Krambuhl; David Deal; David Lax; Debi Tulou; Dee Gavora; Eldon Rucker; Howard Feldman; Jim Williams (MDM); Karen Inman; Kim Ashton; Larry Magni; Marc Meteyer; Martha Jordan; Molly Sinclair; Rick Brown; Robert Barter; Ron Chittim; Theresa Pugh; Tom Lareau; Valerie Ughetta
Subject: FW: MTBE CONTAMINATION

FYI, more info on Maine. Judy

> -----
> From: Bruce Bauman
> Sent: Wednesday, May 13, 1998 3:21 PM
> To: Kim Ashton; Judy Shaw; Robert Barter; Molly Sinclair
> Cc: Greg Smith; Larry Magni; Denise McCourt
> Subject: RE: MTBE CONTAMINATION
>
> Here are links to the Monday and Tuesday articles if you want any gory
> details. Look like they will have fun with this one.
> The Monday article notes that this is a new gas station that just
> opened in July 1997, so this incident, if tied to this facility, will
> likely raise questions (again) about the adequacy of fully upgraded
> USTs and their leak detection systems to prevent releases and to
> detect them properly. It seems this release was only detected through
> some on-site wells drilled for a proposed property transfer. . . .
>
>
> http://www.portland.com/monews/story3.htm
>
> http://www.portland.com/tunews/story5.htm
>

Legal Retention at MSXSOC

From: Stanley CC (Curtis) at MSXWHWTC
Sent: Tuesday, November 03, 1998 12:21 AM
To: Pedley JF (Joanna) at MSXWHWTC; Benton F R [Newcos]
Cc: Mcarragher S (Steve) at OPC
Subject: RE: MTBE IN GROUNDWATER - ISSUES BRIEF

I am out of the office and will return on Thursday. Based on a quick review of the attached material, there are several points that need to be made.

1) Very small releases of MTBE (even small overfills seeping into cracks in the pavement) have the potential to adversely impact groundwater
2) Based on engineering reliability studies, it is likely that a high percentage of sites using MTBE, have a soil and/or groundwater problem. This problem is not just the result of leaking tanks, lines, fills, and dispensers, but is also a result of certain operations.
3) Due to MTBE's high solubility and low attenuation rates, it has the potential to migrate large distances relative to benzene (see attached paper)
4) Those sites which are located over potable groundwater are potentially very high risk sites.
5) Odor and taste will drive the cleanup goals rather than risk. We are currently looking at cleanup goals between 5-15ppb.
6) Once in groundwater, MTBE is extremely difficult to remediate. It's Henry's Law coefficient is very low which means that MTBE prefers to stay in the aqueous phase rather than being sorbed or stripped out of water. Air sparging will be relatively ineffective. We are currently evaluating biological and oxidation remediation techniques.
7) A simple risk assessment for all sites (like we are in the process of developing) will greatly help focus future resources.

My professional opinion is that MTBE and similar oxygenates should not be used at all in areas where groundwater is a potential drinking water supply. If it is used, engineering design and site operations (including active subsurface monitoring) should be carefully developed to minimize the potential for a release.

Curt

ngwa MTBE2 6-3-98.ppt

-----Original Message-----
From: Pedley JF (Joanna) at MSXWHWTC
Sent: Monday, November 02, 1998 6:24 PM
To: Benton F R [Newcos]
Cc: Stanley CC (Curtis) at MSXWHWTC; Mcarragher S (Steve) at OPC
Subject: FW: MTBE IN GROUNDWATER - ISSUES BRIEF

Ron -
As discussed earlier today, grateful for your comments (US perspective additions ?) on the attached. Also by copy to Curtis - please could you review also.

nb: Steve had some sections highlighted in red in his original. I have made a few first pass suggested mods which are in blue with strikeouts of the original in black. Please feel free to change my mods.

From: Joanna Pedley
Equilon Enterprises LLC

Manager Fuels Technology
Westhollow Technology Center - M2603
Tel: 281 544 7795
Fax: 281 544 8585
email: jfpedley@shellus.com
jfpedley@equilon.com

From: McArragher, Steve SIPC-OBMF/51
Sent: Tuesday, October 27, 1998 8:30 AM
To: Pedley, Joanna SHLOIL--; Lee, Rob SHLOIL--
Cc: Wynn-Williams, William SIPC-OBX
Subject: MTBE IN GROUNDWATER - ISSUES BRIEF

Joanna, Rob, as discussed with Rob last week, we are starting to worry about the MTBE contamination issue outside

USA. We have heard concerns in Scandinavia, and now it looks as if Brasil may also have some problems. We have put together an "Issues Brief" intended for Shell company management, and a set of Q&As for external use if necessary. As this is very much a US led issue, we would be grateful for some advice and comments from Equilon. I understand that Curtis Stanley is the expert, but have not approached him directly. What we are looking for is really a political steer, especially on questions like the number of leaking tanks in USA vs. Europe. I would be grateful if you could ask the appropriate contacts in Equilon to look at these documents and let us have comments.

<< File: MTBE issues brief v4.doc >> << File: MTBE Q&As v5.doc >>

With Best Regards
Steve McArragher - OBMF/33
Standard Setting - Gasoline
Oil Products - Strategy and Business Services
Shell International Petroleum Co.
Shell Centre, LONDON, SE1 7NA, UK
Tel 44-171-934-5457 Fax 44-171-934-6014
Internet: Steve.J.S.McArragher@OPC.shell.com

MTBE RELEASE SOURCE IDENTIFICATION AT MARKETING SITES

A Study Conducted for EUSA ESD by

Exxon Research & Engineering Company

3/30/99

By: A. E. Liguori
A. C. Woerner
A. M. Calderon

I. Background

a. Study Basis

In August 1998, EUSA Environmental and Safety Division (ESD) requested Exxon Research and Engineering Company to conduct a study identifying potential release sources of the gasoline additive Methyl-Tertiary-Butyl Ether (MTBE) at Exxon retail marketing sites. Interest in identifying these potential sources is important to EUSA, as well as most other U.S. petroleum marketing companies, because MTBE contamination is increasingly being found in surface and ground waters near gasoline service stations, and has been identified as a potential threat to public drinking water supply systems. By identifying the potential release sources, it is expected that all necessary and appropriate corrective measures can be taken so that accidental releases of MTBE into the subsurface environmental can be prevented.

The objective of this study was to evaluate and categorize the extent and sources of MTBE contamination in soils and ground water at Exxon retail sites. A related objective is for EUSA to use results from this study to assist industry regulatory advocacy efforts with various state and federal environmental agencies. These agencies (with the state of California most notable) are addressing growing public concerns about potential MTBE human health effects, and are enacting regulations to require significant MTBE remediation programs and possibly the elimination of its use as a gasoline additive.

b. MTBE Contamination Issues at Marketing Retail Sites

Methyl tertiary-butyl ether (MTBE) is present in gasoline as an octane enhancer (concentrations up to 9% by volume) or as an oxygenate to reduce ozone and carbon monoxide levels in air (concentrations 11-15% by volume). The presence of MTBE found in surface, ground and drinking waters has been increasing. There are several reasons why increased MTBE presence can be a concern:

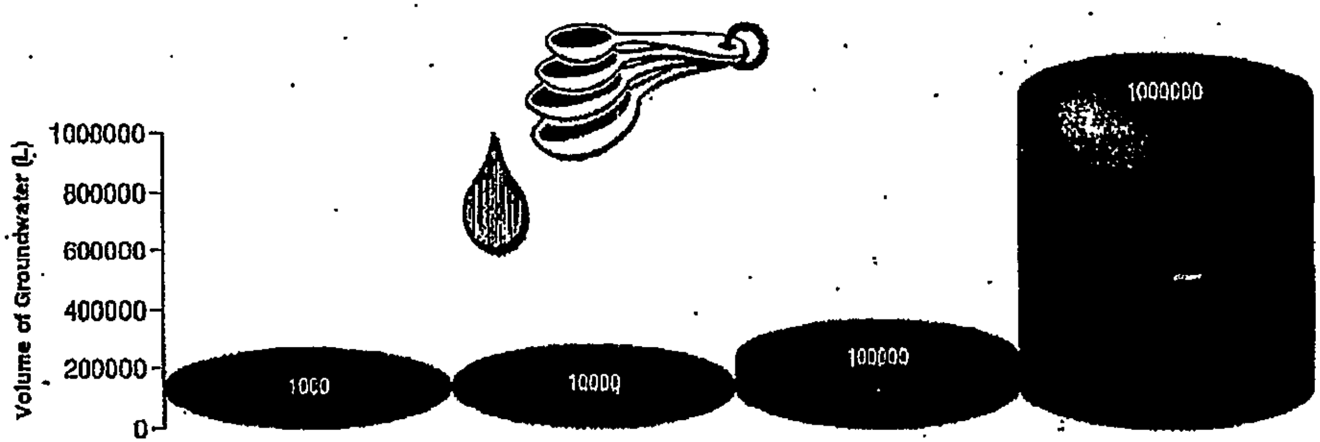
- MTBE behaves differently than other gasoline constituents, i.e. it is relatively:
  - more soluble in water,
  - more volatile from product to air,
  - less volatile when dissolved in water to air
  - less likely to adsorb to soil or organic carbon
  - relatively more resistant to biodegradation.

- There is an increase in awareness since the public can easily detect its existence
  - Taste and odor detectable threshold levels are in the ppb ranges (15-180 ppb)

- Small leaks of gasoline (1 teaspoon) can translate into MTBE ground water concentrations above the taste and odor detectable threshold levels. A standard

Figure I-1: Impact of Small Releases

1 Teaspoon of Gasoline ~ 5 ml
Assume 11.5 vol. % MTBE, 1.5 vol. % Benzene
Potential Impact on Groundwater a Function of Groundwater Volume



Concentrations:				
MTBE (ppb)	413	41	4	0.4
Benzene (ppb)	64	6.4	0.6	0.06

Legal Retention at MSXSOC

From: Stanley CC (Curtis) at MSXWHWTC
Sent: Tuesday, February 02, 1999 6:28 PM
To: Benton F R [Newcos]
Subject: RE: Draft WSPA Q&A on MTBE

Ron,

The paper looks fine. You may, however, want to carefully consider what you say when the new tank upgrades are our first line of defense. While this is very true and the size of leaks has decreased substantially over the years, we are still finding MTBE at sites that have been upgraded. The presence of MTBE may not be due to a leak but could also be due to operational and construction factors.

Curt

-----Original Message-----
From: Benton F R [Newcos]
Sent: February 02, 1999 7:48 AM
To: Kulakowski James M [Texaco]; Olejnik Larry J [Newcos]; Hancock Steve R [Newcos]; Molina Bart [Newcos]; Meeuwsen Mike J [Newcos]; Stanley CC (Curtis) at MSXWHWTC
Subject: Draft WSPA Q&A on MTBE

Please let me know if you have any input/concerns.

-----Original Message-----
From: DMFog@aol.com [SMTP:DMFog@aol.com]
Sent: Friday, January 29, 1999 7:34 PM
To: frbenton@equiva.com
Subject: Oops!

Ron:
I'm a cyber-dummy. Accidentally pushed the delete instead of the print button on your email comment on the MTBE Q&A. Please resend. Attached is the latest draft which reflects all other comments.

Dave << File: Q&A.DOC >>

EXHIBIT
5-6-99es 129
Stanley

Legal Retention at MSXSOC

From: Marshall GR (Glen) at MSXSOPC
Sent: Friday, May 29, 1998 5:36 PM
To: Stanley CC (Curtis) at MSXWHWTC
Cc: Chistolini C. Wayne [STAR]
Subject: RE:

We (Shell) are also moving on said focus. "Achilles Heel" of systems has always been the "Bubba-factor".....the best intentions of hardware manufacturers and designers being ultimately defeated by poor installation and maintenance practices. Have been working last 2 years with Oy U-Cont (Varkaus, Finland) and Trusco Tanks (Fresno, CA) on a modular UST system manufactured in a factory (controlled environment) by properly trained personnel under constant supervision and inspection. Initial evaluations indicate a significantly more reliable system installed with roughly 20%+ savings in total project time and costs (related to UST portion of project). LA City Fire loved concept. Have two projects in for permits in LA Basin now. Coupled with our "Compliance Management Concept" (Veeder-Root Simplicity), overall concept could provide significant movement towards what UST system operation should have been all along. Advise if further concept details desired.

Glen R. Marshall, P.E.
Staff Engineer
Marketing Engineering
Shell Oil Products Company
TSP-1138
Office: (713) 241-1452
Fax: (713) 241-7166
Beeper: (800) 342-4033
Shell ELS: EM10138 @ MSXSOPC
Internet: grmarshall@shellus.com

----Original Message----
From: Stanley CC (Curtis) at MSXWHWTC
Sent: Friday, May 29, 1998 9:03 AM
To: Marshall GR (Glen) at MSXSOPC
Subject: FW:

Glen,

I told API that they had better have a project on slate to evaluate existing systems and new system design, installation, and operations. I already have a good idea what Santa Clara is going to find and if the industry isn't ready with an adequate response/solution, we are all going to look bad. I foresee many agencies requiring extensive groundwater monitoring systems to evaluate whether or not MTBE is being released into the environment, especially in environmentally sensitive areas (near wells, fractured bedrock, etc.).

Curtis C. Stanley
Environmental Technology Directorate - Soil and Groundwater
Westhollow Technology Center
(phone-☺) 281-544-7675 (fax-⊗)) 281-544-8727
e-mail: ccstanley@shellus.com
(This communication per applicable agreements between our respective companies.)

-----Original Message-----
From: Judy Shaw [SMTP:shaw@api.org] <mailto:[SMTP:shaw@api.org]>
Sent: Friday, May 29, 1998 8:57 AM
To: Al Jessel; Brian Harney; C. Fairbrother; Carol Fairbrother; Curt Stanley; Dave Peirce; David Smith; Don Gilson; Eric Vogt; Gene Mancini; Georgia Callahan; Gerry Raabe; Gweneyette Broussard; James Rocco; Jeff Sickenger; Jim Stevenson; John Taunton; Lee Hoffman; Mark Saperstein; Mary Kate Kell; Mike Lobue; Mike Wang; Ned Seppi; Ron Benton; Tim Buscheck; William Doyle
Cc: Alexis Steen; Bill Bush; Bill Frick; Bob Greco; bruce bauman; Carol Henry; Chuck Krambuhl; David Deal; David Lax; Debi Tulou; Dee Gavora; Eldon Rucker; Howard Feldman; Jim Williams (MDM); Karen Inman; Kim Ashton; Larry Magni; Marc Meteyer; Martha Jordan; Molly Sinclair; Rick Brown; Robert Barter; Ron Chittim; Theresa Pugh; Tom Lareau; Valerie Ughetta
Subject:

You need to look at the following; it relates to the source identification /protection discussion we had the other day.

Legal Retention at MSXSOC

From: Marshall GR (Glen) at MSXSOPC
Sent: Friday, May 29, 1998 5:38 PM
To: Stanley CC (Curtis) at MSXWHWTC
Cc: Chistolini C. Wayne [STAR]
Subject: RE:

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Subject: FW:

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Curtis C. Stanley
Environmental Technology Directorate - Soil and Groundwater
Westhollow Technology Center
(phone-@2) 281-544-7675 (fax-@)) 281-544-8727
e-mail: ccstanley@shellus.com
(This communication per applicable agreements between our respective companies.)

-----Original Message-----
From: Judy Shaw [SMTP:shaw@api.org] <mailto:[SMTP:shaw@api.org]>
Sent: Friday, May 29, 1998 8:57 AM
To: Al Jessel; Brian Hamey; C. Fairbrother; Carol Fairbrother; Curt Stanley; Dave Peirce; David Smith; Don Gilson; Eric Vogt; Gene Mancini; Georgia.Callahan; Gerry.Raabe; Gweneyette Broussard; James Rocco; Jeff Sickenger; Jim Stevenson; John Taunton; Lee Hoffman; Mark Saperstein; Mary Kate Kell; Mike Lobue; Mike Wang; Ned Seppi; Ron Benton; Tim Buscheck; William Doyle
Cc: Alexis Steen; Bill Bush; Bill Frick; Bob Greco; bruce bauman; Carol Henry; Chuck Krambuhl; David Deal; David Lax; Debi Tulou; Dee Gavora; Eldon-Rucker; Howard Feldman; Jim Williams (MDM); Karen Inman; Kim Ashton; Larry Magni; Marc Meteyer; Martha Jordan; Molly Sinclair; Rick Brown; Robert Barker; Ron Chittim; Theresa Pugh; Tom Lareau; Valerie Ughetta
Subject:

You need to look at the following; it relates to the source identification /protection discussion we had the other day.

EXHIBIT 11

MAT—9

American Petroleum Institute
1220 L Street, Northwest
Washington, D C 20005
202-682-8000

S.T. Cragg, Ph.D.
Toxicologist
202/682-8342

RECEIVED
JUN 20 1984
R. N. ROTH

TO: Methyl tertiary-Butyl Ether Task Force

FROM: Steven T. Cragg STC

DATE: June 18, 1984

Enclosed are the minutes of the MtBE meeting. If there are items which are of sufficient importance to be added or changed, please send your marked copy to K.A. Hazer, Ph.D. in Chuck's absence. As you know, I will not be available after this date as well.

xc: K.A. Hazer (API)
C.E. Holdsworth (API)
E.O. Siebert (Huels)
N.K. Weaver (API)

THE AMERICAN PETROLEUM INSTITUTE

Medicine and Biological Science Department

Methyl tertiary-Butyl Ether Meeting

API Offices
Washington, D.C.

Tuesday, June 12, 1984
9:30 a.m.

Participants:

R.C. Anderson (API)
C.C. Conaway (Texaco)
S.T. Cragg (API)
B.K. Hoover (ARCO Chem.)
C.J. Kirwin (Phillips)
S.C. Lovre (ARCO Pet.)
S.A. Ridlon (ARCO Chem.)
E.O. Seibert (Huels)
F.B. Thomas (Shell)

The purpose of the meeting was to discuss the status of the composite final report of the toxicity and metabolism studies conducted on MtBE by Bio/dynamics Laboratory, Inc. In addition, the disposition of any future studies was also evaluated, as was the emerging issue of MtBE in ground water. Also considered were such items as; publication of results, longterm storage of study data and materials, final audit of study results, and ACGIH deliberations on an MtBE TLV.

Regarding the composite report, task force comments for the initial draft have been submitted and revisions by the laboratory have been made. The task force still had some minor concerns which it desired changed and decided to extend the deadline for further comment until July 1, 1984. It was realized that the contract laboratory is under no obligation to make further revisions. The changes will be asked for, however. Following this, the decision was reached to accept the report with the additional task force comments. The task force may decide at a later date to have the summarized comments accompany the report or be incorporated into the MtBE file, if Bio/dynamics does not further revise the report.

Several other decisions were reached concerning the Bio/dynamics studies. First, Bio/dynamics will be instructed to discard the

radiolabeled tissues from the metabolism study as the metabolites within them may have volatilized/sublimed over time to the point that if they were now analyzed, misleading values might be generated. Second, the remaining tissues and data will be sent to the API repository for those studies specifying short storage intervals in the contract. Third, a follow-up quality assurance audit was recommended by the task force to be performed on the reproduction/teratology study. The task force realized, however, that API staff was presently understaffed and left the decision of prioritization of this effort to staff.

Dr. Conaway recommended that, if possible, at least three papers be published from the Bio/dynamics MtBE studies. These would include publications on; 1) two-species teratology, 2) reproduction, and 3) metabolism. Concern was expressed that the metabolism data may not be sufficient for publication. Various names were recommended as authors for these papers. Dr. Von Bulow will be encouraged to submit a paper on the Huels sponsored 90-day study and ARCO may submit its genetox data. An attempt will be made to submit all of these as a package to a single journal such as the Journal of Environmental Contamination and Toxicology. Dr. Conaway asked that all draft papers be submitted to API no later than September 1, 1984. API will act as the "clearing-house" for the papers and will submit the packet to the journal.

In view of the NTP's deprioritization for conducting a carcinogenicity bioassay on tertiary-butyl alcohol (TBA), a known metabolite of MtBE, the task force decided little need existed for additional metabolism studies at this time.

Some of the task force members indicated that MtBE had been found in ground water near leaking underground storage tanks from their service stations. Usually the service stations having these problems have not been directly owned by the company, but are franchise stations with older storage tanks. It appears that the oxygenate components of gasoline, such as MtBE, migrate most rapidly underground and are the most noticable from an organoleptic standpoint. Pending votes from Exxon, Tenneco and Dr. Von Bulow of Huels, the task force decided to give the remaining funds in the MtBE budget to the API research effort on gasoline in groundwater. This is contingent upon API's testing of oxygenates (and MtBE in particular) in such a program. However, if such an API research effort does not include the testing of oxygenates/MtBE, the remaining funds of $28,000 will be returned to the companies participating in the MtBE testing program.

Regarding a similar issue, the proposal by Dr. Finn on groundwater contamination will be referred back to Dr. David Chen (API staff to the Environmental Biology and Community Health Committee) for review by this committee.

Finally, as a point of information, Ms. Hoover reported that all

data in API files concerning MtBE had been forwarded to J. Gesser representing the ACGIH. This organization will propose a TLV for MtBE in the near future. It was speculated that such a level might be similar to other ethers (i.e., 400 ppm).

prepared by:

STC

Steven T. Cragg, Ph.D.
API Toxicologist
6/15/84

Hydrocarbons and Organic Chemicals in Ground Water—Prevention, Detection and Restoration

November 12-14, 1986
The Westin Galleria, Houston, Texas

Sponsors

National Water Well Association
American Petroleum Institute

Published by

National Water Well Association
6375 Riverside Dr.
Dublin, Ohio 43017

Produced by

Water Well Journal Publishing Co.
6375 Riverside Dr.
Dublin, Ohio 43017

Abstract

The NWWA/API Conference and Exposition on Petroleum Hydrocarbons and Organic Chemicals in Ground Water—Prevention, Detection and Restoration, was held in Houston, Texas, on November 12-14, 1986. The conference covered a wide range of topics including prevention of ground water contamination from underground storage tanks, migration of petroleum hydrocarbons and organic chemicals in ground water, characterizing contaminant transport in the vadose zone, physical and chemical processes in the subsurface, utilizing remote sensing for detecting and delineating subsurface contamination, monitoring and analytical techniques for contaminant identification, characterizing subsurface geology and mapping contaminant movement, detection of volatile organic chemicals in ground water, remedial action planning and risk assessment, innovative applications of new and established technologies for remedial action and case histories. Government officials, consulting geologists and engineers, researchers, industry representatives and other interested persons met to learn and discuss state-of-the-art techniques employed in preventing, detecting and restoring ground water contamination resulting from petroleum hydrocarbons and organic chemicals. Additionally, the lastest in state-of-the-art instrumentation and equipment was discussed and displayed. The conference provided a forum for all who attended to communicate and share their experiences in this rapidly developing field.

These proceedings are a compilation of papers presented by the symposium speakers.

Disclaimer

The papers appearing in this set of proceedings of the conference previously described have been reproduced exactly as submitted by the authors without technical and grammatical editing or peer review. It is the belief of the conference coordinating committee that these papers have technical merit or they would not have been selected for presentation. Complete accuracy or technical viability cannot, however, be assured. It is believed, nevertheless, that early publication and rapid dissemination outweighs any possible reduction in quality that may be encountered.

Library of Congress Cataloging-in-Publication Data

NWWA/API Conference on Petroleum Hydrocarbons and Organic Chemicals in Ground Water—Prevention, Detection and Restoration (1986 : Houston, Tex.)
Proceedings of the NWWA/API Conference on Petroleum Hydrocarbons and Organic Chemicals in Ground Water—Prevention, Detection and Restoration, November 12-14, 1986, the Westin Galleria, Houston, Texas.

Includes bibliographies
1. Water, Underground—Pollution—Congresses. 2. Petroleum chemicals—Congresses. 3. Hydrocarbons—Congresses. 4. Chemistry, Organic—Congresses. 5. Water chemistry—Congresses. I. National Water Well Association. II. American Petroleum Institute. III. Title.

TD426.N88 1986 363.7394 87-1623

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C. Physical and Chemical Processes in the Subsurface

Session III
Detection

A. Utilizing Remote Sensing for Detecting and Delineating Subsurface Contamination

MTBE as a Ground Water Contaminant

by
Peter Garrett, Marcel Moreau
Maine Department of Environmental Protection
Augusta, ME 04333
and
Jerry D.Lowry
University of Maine, Orono, ME 04473

Abstract

MTBE (Methyl tertiary Butyl Ether) is now among the top fifty chemicals produced in the United States. It is used exclusively as an octane enhancer in gasoline, in which it constitutes up to 11 percent of total volume .

MTBE is soluble in water at 4.3%. This compares with the relative insolubility of benzene (0.18%), toluene (0.05%), and xylene (0.02%). However, the BTX compounds are more soluble in MTBE than they are in water. When gasoline plus MTBE leaks to ground water, the MTBE spreads both further and faster than the gasoline, and the concentration of gasoline dissolved in ground water increases.

We have investigated several cases of ground water contamination resulting from spills of gasoline with MTBE. In one such case, several household wells became contaminated with MTBE only. In one household, concentrations of up to 690 ppb MTBE were measured, (with other gasoline constituents combined at less than 10ppb). The well nearest the spill had concentrations of up to 126,000 ppb gasoline including MTBE. At another site, concentrations exceeded 600,000 ppb gasoline including MTBE. This contrasts with the usual maximum dissolved concentration of gasoline in ground water near spill sites of about 10-30,000ppb (when no MTBE is present).

Toxicity data on MTBE indicate that it is an irritant like many of the other components of gasoline. Maine has set a maximum contaminant level of 50ppb.

Ground water contaminated with MTBE is difficult to remediate. Filtration through activated carbon is not cost effective for MTBE: a 2 cubic foot bed lasts a month or less as a household treatment system, even with an influent concentration of MTBE as low as a few parts per billion. However, air stripping systems are capable of removing MTBE, but only if very high air to water ratios are used.

Introduction

With the reduction in lead content of gasolines, octane enhancement is now achieved by several compounds, including ethanol, methanol, tertiary-butyl alcohol (TBA), Oxinol™ (a blend of methanol and TBA), "reformate", "alkylate", or extra doses of toluene and xylene. But the additive which is increasingly popular at the refineries where gasoline is blended is MTBE (methyl tertiary-butyl ether, also known as TBME, or sometimes as 2-methoxy 2-methyl propane), the subject of this paper.

Facts about MTBE

MTBE is an "oxygenate" and one of the few compunds in gasoline to contain oxygen. Its structure is given in Fig. 1.

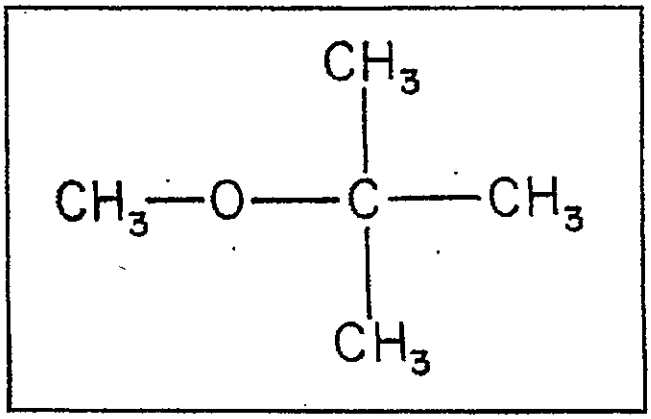

Fig. 1. Chemical structure of MTBE. The horizontal CH_3-O-C bonding represents the ether molecule, while the vertical CH_3-C-CH_3 unit represents a propane molecule.

MTBE is now among the top 50 chemicals produced in the United States (47th by weight in 1984, 44th in 1985: Chemical and Engineering News, June 1985 and 1986). ARCO and Texas Petrochemicals are the major producers of MTBE, most of which is made for sale to other refineries where it is blended into gasoline. 30 plants now produce MTBE throughout the world, with an additional 20 planned. Total U.S. production is now running over 80,000 barrels per day (Octane Week, Feb. 2, 1987). Currently, 95% of that total is produced in Texas, from where it is shipped, either pure or blended in gasoline, to other parts of the US east of the Rockies. At present, little is used in western States, in Canada, or in Europe. However, MTBE use in the west and in other countries is expected to increase with increasing emphasis on lead phasedown.

MTBE was first produced by ARCO in the 1960s, when they patented a process for removing branched olefins such as isobutylene from hydrocarbon streams. MTBE is manufactured by reacting this isobutylene with a small amount of methanol. It was not until 1979, however, that MTBE was first produced commercially. Since 1980, production has increased at a rate of about 40% per year. It is currently used in about 10% of the nation's gasoline, though the proportion of gasolines with MTBE may be much higher in some parts of the US. (From ARCO advertising materials and personal communications.)

EPA allows the blending of MTBE into gasoline up to about 11% by volume. The exact proportions of MTBE in a particular gasoline depend on the composition of the crude, the octane rating of the distillate, and the required octane rating of the final blend. MTBE is usually blended at between 2 and 7%. MTBE is used in both unleaded and "regular" gasolines. Usually the highest proportions are to be found in unleaded premium. (ARCO, personal communication.)

Among other claims made about MTBE are: 1) that it has a blending octane value greater than that of toluene, reformate or alkylate; 2) that it is compatible with all types of automotive and tank liner materials; 3) that it does not have a phase-separation problem in the presence of water (which is a problem with ethanol and methanol); and 4) that its use in gasoline reduces carbon monoxide and hydrocarbon emissions in most cars (from ARCO's advertising pamphlets).

Transport and Fate of MTBE in the Environment

MTBE is soluble in water at 4.3% (ARCO data). This compares to the relative insolubility of other major components of gasoline, as summarized in Table 1.

Table 1: Solubility of some major gasoline components

	binary equilibrium solubility in water at 25°C		
	mg/l	%	relative to benzene
benzene	1,780	0.18	1
toluene	515	0.05	0.3
m-xylene	170	0.02	0.1
MTBE	43,000	4.3	24

(Data from API, 1985, Table 2-1 for BTX. That source gives a range of values for each component. Data for MTBE from ARCO factsheets.)

Though it is important to realize that the equilibrium solubilities listed above are rarely reached in nature, the significance of the figures lies in their ability to predict how MTBE behaves as a ground water contaminant relative to other components of gasoline, of which benzene is the most soluble (API 1985, table 2-2).

MTBE is only used as an additive of gasoline. Thus one can assume that, except perhaps around refineries, the presence of MTBE in ground water signifies the nearby presence of gasoline.

When gasoline leaks to ground water, it contaminates the unsaturated zone and the water table with free product in the vicinity of the leak. Recharge to ground water by precipitation percolates through this product contamination zone, dissolving components of gasoline in approximate proportion to their solubilities. Although we know of no laboratory data, we infer that the concentration of MTBE in the recharge water will be considerably enhanced over that of the other components of gasoline for the following two reasons:

First, MTBE is at least an order of magnitude more soluble than other components of gasoline. Second, at a concentration of up to 11% of the pure product, MTBE may be one of the largest components of the spilled gasoline.

Once in the zone of saturation, the dissolved components travel with ground water. Concentrations of contaminants diminish as distance from the spill increases because of dilution, sorption onto soil particles, and biodegradation (Barker, Patrick and Major, 1987). In general, sorption of organic compounds is inversely proportional to their solubility (API 1985, p.4), so we expect MTBE to have a low sorption onto soil particles.

From the above, we infer that a plume of MTBE in ground water should be more extensive than the plume of other gasoline components. There should be areas on the outer fringes of the total plume where MTBE is the only detectable contaminant. The MTBE plume will appear as a "halo" around the dissolved gasoline plume, which in turn appears as a halo around the free product plume.

The greater solubility of MTBE in water, combined with the near 100% solubility of all gasoline components in MTBE may increase the sum total of all dissolved gasoline components in ground water. If this is so, then spills which contain MTBE should result in higher concentrations of total dissolved hydrocarbons in ground water than spills with no MTBE. This would be a co-solvent effect in the sense of Munz and Roberts (1986).

With respect to the biodegradability of MTBE, Fujiwara and others (1984) found that the presence of MTBE had little effect on the biodegradability of blended gasoline. But they did not discuss the biodegradability of MTBE alone.

Identification and Quantification of MTBE in Ground Water

The first indication of the presence of MTBE in domestic water supplies comes from its odor. It is said to have a "terpene-like" odor (ARCO personal communication), but householders more often describe it simply as a "chemical" odor. Our first contamination case, in 1984, was initially mistaken for one of hazardous waste leachate because of the unusual smell. From a large number of cases of contaminated domestic wells we have found that people can detect the odor of MTBE in their water at concentrations as low as 20-50 parts per billion.

In the lab, the identification of MTBE is difficult when it is associated with the other components of gasoline (e.g. Fig. 2a), but is simple when it occurs as a single component in water (Fig. 2b). At the Public Health and Department of Environmental Protection Laboratories in Maine, gasoline is analyzed in water using head space gas chromatography (GC). Fig. 2a shows the kind of scan which that method produces. Each constituent of the mixture shows itself as one or a series of peaks, but the peaks themselves do not provide unique identification because their exact position on the scan can vary depending on chromatographic conditions.

Because gasoline is initially a variable mixture, with each component having its own unique solubility and sorptive properties, every different spill has a different GC trace. We have found, however, that MTBE separates out as a distinct peak between the usually prominent peaks of iso-pentane and 2-methyl-pentane. The exact time of its emergence on the GC scan is dependant on column length, whether packed or capillary columns are used, and the specific temperature program of the run.

(Note that this is not a standard EPA method, though it is most akin to Method 601. Our State labs in Maine do not separately identify benzene, toluene, xylene and ethylbenzene as the indicators of gasoline contamination, because we believe that the many other components should not be ignored. If your laboratory chemists only identify the BTX components, then they should obtain an MTBE standard and separately identify it along with BTX. If your lab follows a total hydrocarbon analytical method, like Maine's, it is still useful to get the lab to separately identify and quantify MTBE. This is because gasoline with MTBE behaves differently in ground water than gasoline alone. For further details on labratory procedure, contact the Jack Krueger at the Public Health Lab, State House Station # 11, Augusta, ME 04333, (207) 289-2727.)

We have so far identified about 30 other sites in Maine where MTBE is a component of the spilled gasoline. This accounts for about 90% of the recent analyses which we have routed through the Public Health Lab. They all seem to follow the same general pattern that:

1) concentrations of gasoline and MTBE in ground water at the center of the plume can be extrememely high. Our record high concentration so far is over 600,000 parts per billion in one household well with the intake pipe beneath floating product in a sand and gravel aquifer. This contrasts with the usual maximum concentration for similar situations without MTBE of about 10-30,000 parts per billion.

2) MTBE can occur as the only contaminant above detection limit over large areas of the plume. In one plume, believed to have originated from a small driveway spill, MTBE was the only detected contaminant of the spill.

3) the MTBE plume seems to occur as a halo around the gasoline-plus-MTBE plume. Where the plume is expanding, detection of MTBE precedes detection of gasoline in contaminated wells.

Toxicity of MTBE

The American Petroleum Institute, and several MTBE producers have run a battery of toxicity tests to assess its hazards. A summary of the results of these tests is as follows:

Within the limits of the testing, MTBE was found to be not very toxic, with effects similar to those which are characteristic of other ether compounds such as diethyl ether, formerly the standard surgical anaesthetic. It appears not to be genotoxic, and because it was "negative with and without activation" on the Ames test, it is probaby not carcinogenic. MTBE is, however, a skin and eye irritant in more than one rodent species at high doses.

ARCO's health monitoring of their workers at MTBE manufacturing and transport facilities seem to indicate no adverse effects at time weighted average doses of up to 3ppm in air. But as is commonplace with any ground water contaminant getting into household water supplies, the concern it raises and the aggravation it causes the affected householders is a serious health effect independant of its toxicity.

Four reasons for concern over the toxicity of MTBE, and its presence in domestic well water are the following:

1) It is very mobile in ground water. Thus concentrations recorded from a well one week may be quite different the following week. Occassionally we have noted increases in the concentration of MTBE in domestic supplies of about an order of magnitude within a couple of days. Thus it is important to reduce concentrations in domestic water supplies as soon as they are discovered.

2) Plumes of MTBE in ground water are associated with plumes of gasoline, with its more varied and toxic components. Thus detection of MTBE should be considered a warning bell.

3) There is concern over MTBE's irritant properties.

4) MTBE is probably a nervous system depressant (like other ethers and the BTX components of gasoline) at high concentrations .

With these considerations in mind, the State Toxicologist for Maine has set a recommended maximum concentration level for MTBE in domestic water at 50 parts per billion, the same as for gasoline.

Removal of MTBE from Household Ground Water Supplies

Treating ground water supplies contaminated with MTBE is considerably more difficult than when gasoline alone is present.

Typically, granular activated carbon (GAC) is used as an interim measure to remove gasoline contamination from household ground water supplies (Hall and Mumford, 1987). But MTBE, with its relatively high solubility, is poorly adsorbed by GAC: thus breakthrough of MTBE comes early. Laboratory (API, 1983; and Lowry, unpublished experiments) and field (DEP experience) data substantiate this point. In general the bedlife of GAC units is less than 25% of what it would be if no MTBE were present. Or, in practical terms, a typical 2 cubic foot GAC unit will last only a few weeks or months when MTBE is present (the length of time being dependant on concentrations of contaminants, rate of water use, and the brand and type of GAC employed). Because the cost of GAC treatment is primarily in the replacement of the carbon bed, this makes GAC uneconomic when MTBE is present above a few tens of parts per billion.

Aeration is an alternative method of treatment for the removal of MTBE from water supplies. Aeration does not have the problem of saturation of an adsorptive medium. But unfortunately, the relatively low volatility of MTBE makes it difficult to remove compared to the other components of gasoline. Here the Henry's Law Constant is the controlling variable: for MTBE it is estimated to be less than 0.05, whereas it is 0.20 and 0.23 for benzene and toluene respectively. However, the efficacy of aeration can be increased by lengthening the aeration time or increasing the air to water ratio.

Lowry Engineering has developed a unique batch aeration system with variable aeration time, which has treated individual domestic water supplies contaminated with more than 200,000 parts per billion total gasoline and MTBE, with the treated water having no detectable hydrocarbons. Several units are now being monitored in the field where they have been performing satisfactorily. We have found that the system is the most effective and secure against breakthrough when contamination of ground water exceeds a few parts per million total gasoline or fuel oil, or more than 50 ppb MTBE.

For further information on treatment see Lowry and Lowry (1985).

Conclusions

1) MTBE is a more soluble and more rapidly spreading ground water contaminant than other components of gasoline,

2) Its presence in spilled gasoline increases dissolved concentrations of gasoline in ground water in the immediate vicinity of the spill to about an order of magnitude above typical values for spills in which there is no MTBE, and

3) It is more difficult to remove from contaminated water than the other components of gasoline.

Discussion of Policy Options

As this work grew out of a regulatory background founded on the need to limit the damage caused by leaking underground storage tanks, it is natural for us to think in terms of what these findings should mean in terms of new policy decisions. The following are a sample. There may be other options, and we are not advocating one option over another. The object of this discussion is to stimulate the reader into thinking of what should be done.

Option 1: MTBE could be abandoned as an additive in gasoline stored underground. Replacement of MTBE by ethanol, methanol or TBA is not, however, likely to improve the

situation vis a vis ground water. All are more soluble than MTBE, and TBA is almost impossible to remove by carbon adsorption or air stripping (API, 1983).

But octane enhancement without additives is possible (DoE, 1985). It is achieved by "reforming" some of the components of the distillate during the refining process so that the refined gasoline already has sufficient octane. Some producers prefer this "reformate" method of obtaining the required octane, and it does not have the environmental disadvantages of MTBE or its alcoholic competitors.

Option 2: Because the increased mobility of plumes containing MTBE results in greatly increased volumes of contaminated ground water, gasolines in which MTBE is blended could perhaps be stored only in double-contained facilities, or those with sensitive and effective leak detection systems. (This policy option may also have to be applied to gasolines blended with any highly soluble additive.)

Option 3: Because of the rise in popularity of MTBE and other very soluble additives to replace lead as the octane enhancer, it is perhaps time to acknowledge that all underground storage must be as secure as possible.

One Final Point. The Human Side of MTBE Contamination.

Several colleagues have commented that MTBE may be useful as a contaminant tracer because it is apparently less toxic, and precedes and travels further than the BTX components. We beg to differ. That opinion forgets the human element of gasoline spills.

The North Berwick spill contaminated the wells of two homes to concentrations an order of magnitude higher than if there had been no MTBE. The young couple in one of those homes had to wait for us to invent a whole new method of water treatment for their housefold supply. The young family in the other decided that water treatment was not the way to go, and chose instead to truck in water, at considerable expense and nuisance. The fact that MTBE appears to be less toxic than benzene was no consolation to the parents of young children. The anguish these two families underwent cannot be put into words.

The six other homes in North Berwick with only MTBE in their water were worried about when they would get gasoline too. The trauma associated with the contamination of a home water supply is not proportional to the toxicity of the contaminant detected.

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EXHIBIT 12

Shell Oil Products Company

P O Box 4848
Anaheim CA 92803

511 North Brookhurst Street
Anaheim CA 92801

Report is in separate binder

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

JUNE 25, 1996

Dr. Robert Ghirelli, Executive Officer
California Regional Water Quality Control Board
Los Angeles Region
101 Centre Plaza Drive
Monterey Park, CA 91754-2156

RE: Methyl Tertiary Butyl Ether (MTBE) Pollution Investigation - City of Santa Monica
Charnock Well Field (Your File NO. 96-042)

Dear Dr. Ghirelli:

The following information is furnished in response to your letter on this subject to Ms. Karen Haynes dated May 23, 1996. It responds to the specific information requested by Appendix A to your May 23 letter and provides it in the sequence that information is requested.

MTBE INFORMATION

Shell Oil Company SU2000E Gasoline, introduced in the first quarter of 1990, was the first Shell gasoline manufactured, transported or sold in California that contained MTBE. All Shell gasolines manufactured, transported and sold in California contained MTBE after October, 1992. Shell refineries located in Texas and Louisiana intermittently used MTBE to enhance gasoline octane levels beginning in early 1980. It is possible, but very unlikely, that these refineries supplied some tiny percentage of the gasoline Shell marketed in California in the 1980's. (Shell had three refineries located on the West Coast that supplied almost all of Shell's product throughout this period.) In addition, Shell occasionally purchased small amounts of gasoline on the open market to fulfill its needs. Since our purchase specifications did not reference MTBE during the 1980's and early 1990's, it is also possible that some of the purchased gasoline contained MTBE.

Enclosed as Attachment I are two documents authored by Mr. James M. Davidson of Alpine Environmental, Inc., Fort Collins, Colorado. These documents deal specifically with technical aspects associated with the issue of MTBE in ground water. Shell has no information about MTBE of any real significance to the issue of MTBE in ground water that is not adequately addressed in Mr. Davidson's work.

PIPELINE INFORMATION
(Shell Pipe Line Corporation)

The Shell Pipe Line Corporation owns and operates the Ventura Products Pipeline located in a right-of-way within Sawtelle Boulevard. This pipeline lies immediately to the east of the Charnock Field as depicted on the sketch that accompanied your May 23 letter. A map showing the location of the sections of the Ventura Products

Pipeline within a two mile radius of the Charnock Field is enclosed as Attachment II. This pipeline has been exclusively owned by the Shell Pipeline Corporation since prior to January 1, 1980, and has transported only Shell gasolines from that date to the present time.

Shell Pipeline Corporation also owns and operates the Ventura Crude Pipeline a small segment of which is located within some one and one-half miles of the Charnock Field. We have not included a map of this pipeline because it has never transported any substance that contains MTBE. The Ventura Crude Pipeline has been exclusively owned and operated by the Shell Pipeline Corporation since prior to January 1, 1980.

Copies of profile drawings for sections of the Ventura Products Pipeline located within two miles of the Charnock field are enclosed as Attachment III. These profile drawings show materials of construction, dates of installation and burial depth. The operational capacity of the segment of the line under discussion is approximately 725 barrels per hour.

No California Pipeline Safety Act hydrostatic tests have indicated that the line leaked. Copies of the tightness certifications for tests performed in 1988 and 1993 are enclosed as Attachment IV. The Ventura Products Pipeline is continuously monitored whenever it is in operation. Pressure readings are compared via computer at intervals of less than 60 seconds. All recorded anomalies are investigated. None were found to be the result product releases.

Our records do not contain any indication of a product release within two miles of the Charnock field nor any indication of contaminated soil along the Ventura Products Pipeline right-of-way. Moreover, discussions with appropriate maintenance and operating personnel responsible for the Ventura Products Pipeline provided no indication of contamination.

Appendix A concludes with a request for a technical report that details an active program to evaluate the length of all petroleum pipelines within two miles of the Charnock Well Field. We believe it is inappropriate to perform any evaluation of the Ventura Crude Pipeline because it has never transported any substance that contains MTBE and because it's closest point is nearly mile and one-half from the Charnock Field. We will take immediate steps to evaluate the Ventura Products Pipeline. The next California Pipeline Safety Act hydrostatic test of this pipeline is scheduled for 1998. However, we will now make arrangements to perform a California Pipeline Safety Act test of the segment within approximately two miles of the Charnock field during the third quarter of 1996. We will provide you with the results of this test immediately thereafter. Should these test results indicate that further evaluation is warranted, we will then provide a detailed description of our proposed follow-up investigation.

UNDERGROUND GASOLINE STORAGE TANKS INFORMATION:
(Shell Oil Products Company)

There are three operating Shell stations in the list of sites located within the one-mile radius from the Charnock Wellfield. The three Shell stations are at the following locations:

1. 3500 Centinela, Los Angeles
2. 10815 National, Los Angeles
3. 3801 Sepulveda, Culver City

Attachment V contains the summary report addressing the items listed in Appendix A regarding underground gasoline storage tanks.

We believe that the foregoing provides all the information requested by Appendix A. Should you or your staff have any further questions, please contact our Carlton Jordan at (310) 816-2060 for matters related to the Ventura Products Pipeline or Karen Haynes at (714)-520-3395 for matters related to Shell service stations.

ULTRAMAR DIAMOND SHAMROCK
CORPORATION

Charles E. Flaniken,
Manager, Quality Control

September 29, 1997

California Environmental Protection Agency
San Francisco Bay Regional Water Quality Control Board
2101 Webster Street
Suite 500
Oakland, CA 94612

Gentlemen:

RE: Request for Information on Gasoline Additives, Letter dated July 29, 1997

As requested in your letter to Mr. Terry Fox of Ultramar Inc., here is a report detailing additives introduced into gasolines distributed in the San Francisco Bay Area by Ultramar Inc. and its predecessor companies during the period from 1978 - 1997.

We have attempted to provide all the information you requested. Kevin Graves of your staff was very helpful in clarifying the scope of your information gathering. If you have questions about the information included in the report, you may contact me directly at the telephone number listed on the letterhead below.

Respectfully,

C. E. Flaniken

C. E. Flaniken
Manager, Quality Control

cc: T. Fox, S. Epperson (no attachment)

P.O. Box 696000, San Antonio, Texas 782269- 6000 - (210) 530-8516 / Fax (210) 530-8856

ULTRAMAR DIAMOND SHAMROCK
GASOLINE ADDITIVES
SAN FRANCISCO BAY AREA, 1978 - 1997
October 1, 1997

Prepared for: San Francisco Bay Regional Water Quality Control Board
By: Charles E. Flaniken, Quality Control Manager

Table of Contents

Scope

This report is in response to your letter to Mr. Terry Fox of Ultramar Inc. dated July 29, 1997. In addition to the specific information requested about the identity, period of use, concentration, name of supplier, and available health & safety data for the various additives introduced into gasolines at the direction of Ultramar Inc. and its predecessor companies during the last 20 years, we will offer a brief overview of our business activities in the San Francisco Bay Area, discuss limitations to the data provided, and offer suggestions for other sources of information about other additives potentially included in the San Francisco Bay Area.

General Business Information

Ultramar Diamond Shamrock is an independent oil company with headquarters in San Antonio, Texas. Through our subsidiary company, Ultramar Inc., and its predecessor companies, we have refined and marketed gasoline products in California for more than 65 years. We currently own and operate one refinery in California, located in Wilmington, CA. We operate more than 150 company owned service stations, identified with the Beacon or Ultramar brands, throughout the state and supply an additional 200 stations through Branded Contract agreements. Although we neither own nor operate any gasoline distribution terminals, we do supply product to the independent petroleum market through a number of third party terminals.

San Francisco Bay Area Business Activities

Our business activities in the San Francisco Bay Area during the years 1978 - 1997 have been exclusively the additization, transportation, and marketing of petroleum products. We have never owned or operated a refinery or petroleum distribution terminal in the San Francisco Bay Area. We currently operate 47 company owned service stations in the greater San Francisco Bay Area distributed as follows:

County	Number Company Owned Stations
Alameda	6
Contra Costa	7
Marin	0
Napa	4
San Francisco	0
San Mateo	0
Santa Clara	9
Santa Cruz	9
Solano	5
Sonoma	7
Total	47

Brief History of Gasoline Additization in California

Until 1992, gasoline additization was a matter of choice in California. No Federal or State regulations directly required the use of any type of gasoline additive. Use of additives was primarily dictated by (1) their effectiveness in achieving or maintaining compliance with general petroleum product specifications, such as ASTM specifications, (2) recommendations or requirements of OEMs, or (3) marketing considerations.

Over the years, additives have been injected into gasolines at a variety of points in the gasoline manufacturing and distribution system. Additives can be injected into gasoline blending components at the refinery (i.e. antioxidants), used as a blending component at the refinery (i. e. MTBE and other ethers), used as a blendstock at terminal transport truck loading racks (i.e. ethanol), and injected into finished gasolines at terminal transport truck loading facilities (i.e. fuel system detergent additives)

Although there were no direct requirements to use additives, beginning in the early 1970's provisions of the Federal Clean Air Act required additive manufacturers to register additives that were intended for use in transportation fuels with the Office of Fuel and Fuel Additive Registration.

The regulation also required fuel manufacturers to register all additives added to transportation fuels through their direct actions or under their direction and to report such use on a quarterly basis.

The use of detergent additives and oxygenates was mandated by Federal and State regulations beginning in 1992. Additive packages effective in controlling engine deposits were required in California by CARB regulation beginning in January, 1992. A part of the CARB detergent additive regulation required registration of all detergent additives intended for use by fuel suppliers and certification of all potential gasoline detergent additives by CARB staff.

Beginning in November, 1992, all California gasolines were required to have a minimum oxygen content of 1.8 wt% during the winter months to satisfy the requirements of both Federal and State Clean Air regulations. This necessitated the widespread use of oxygenates in California gasolines. Prior to this time, oxygenates were blended voluntarily for business purposes.

The use of detergent additives and oxygenates has been modified by subsequent regulations including Federal detergent additive regulations effective in January, 1994 and July, 1997, Federal RFG requirements effective in parts of California beginning in January, 1995, and CARB RFG regulations effective March, 1996.

Ultramar Inc. Gasoline Additives, San Francisco Bay Area

Ultramar Inc. additization activities in the San Francisco Bay Area have been confined exclusively to additization of gasolines or non-oxygenated blendstocks at transport truck loading facilities located in third party terminals. Since we have not owned or operated these facilities, our role has always been an indirect one, selecting additives individually or jointly with other users of the system and monitoring and reporting use of the additives as required by good business practice and/or governmental regulation.

Since all of the gasoline sold by Ultramar Inc. and predecessor companies in the San Francisco Bay Area was refined and/or imported by other companies and was obtained by purchase from or exchange with another company, the

following list does not include additives that may have been added by others parties prior to our ownership of the gasolines or non-oxygenated blendstocks. A discussion of additives in purchased or exchanged gasolines is included in a later section, "Purchased/Exchanged Gasolines".

The following table lists the commercial or brand name of the additive, manufacturer, purpose for use, and approximate period of use in San Francisco Bay Area gasolines listed in chronological order. Additional notes on each additive follow the table and MSDS data for each additive are included as attachments.

Prior to 1981, no additives of any kind were added by Ultramar Inc. or its predecessor companies to gasolines sold in the San Francisco Bay Area. Nor did Ultramar Inc. or its predecessor companies direct others to inject additives specified by Ultramar Inc. into gasolines sold in the San Francisco Bay Area prior to 1981.

Ultramar Inc. Gasoline Additives, 1981 - 1997

Additive Name	Manufacturer	Purpose	Estimated Dosages	Period
Ethanol, Fuel Grade	Various	Octane Improver & Oxygenate	0 - 10 vol%	1981 - 1991
DMA 67Y	E. I. Dupont	Detergent & Corrosion Inhibitor	0 - 52 mg/l	1986 - 1991
Tolad MFA-10	Petrolite	Detergent & Corrosion Inhibitor	0 - 30 mg/l	1991
OGA 476PL	Chevron Chemical Co.	Detergent & Corrosion Inhibitor	0 - 877 mg/l	1991 - 1995
Ethanol, Fuel Grade	Various	Octane Improver & Oxygenate	0 - 6.2 vol%	1992 - 1995, Oct. - Feb.

Ultramar Inc. Gasoline Additives, 1981 - 1997 (continued)

Additive Name	Manufacturer	Purpose	Estimated Dosages	Period
8195C	Lubrizol Corp.	Detergent & Corrosion Inhibitor	0 - 528 mg/l	1993 - 1995
OGA 477PL	Chevron Chemical Co.	Detergent & Corrosion Inhibitor	0 - 483 mg/l	1995 - 1996
8192S	Lubrizol Corp.	Detergent & Corrosion Inhibitor	0 - 321 mg/l	1995 - 1997
8247E	Lubrizol Corp.	Detergent & Corrosion Inhibitor	0 - 184 mg/l	1997 -

Ethanol, Fuel Grade (MSDS included): Used as a gasoline extender and octane booster in a portion of the gasolines distributed by Ultramar Inc. during the period from 1981 - 1991. The ethanol used was supplied by a variety of suppliers, primarily Archers Daniel Midlands (ADM). Denatured fuel grade ethanol was blended into gasolines at 10 vol% at terminal transport truck loading racks during the years 1981 - 1991 and at 6.2 vol% from 1992 - 1995. While ethanol blended gasoline was sold at most company operated Beacon and Ultramar branded stations, gasolines without ethanol were also available at the option of independent branded dealers and other wholesale customers.

DMA 67Y (MSDS included): Added by ethanol suppliers to ethanol used for blending into a portion of the gasolines distributed by Ultramar Inc. in the San Francisco Bay Area from 1986 - 1991. DMA 67Y is a multifunctional additive manufactured by E. I. Dupont de Nemours, providing detergency and corrosion inhibition. This additive was included in the ethanol blended into gasolines as described above. Fuels blended with 10 vol% fuel grade ethanol

containing DMA 67Y yielded a concentration of about 51 mg/l of DMA 67Y in the finished blend. Not all gasolines distributed by Ultramar Inc. during the period contained DMA 67Y (See the discussion of fuel grade ethanol above.)

Tolad MFA-10 (MSDS included): Added to a portion of the gasolines distributed by Ultramar Inc. in the San Francisco Bay Area during 1991. Tolad MFA-10 is a multifuntional additive manufactured by Petrolite, providing detergency and corrosion inhibition. This additive was injected into gasolines by computer controlled systems at terminal transport truck loading racks at a dosage of about 30 mg/l. Tolad MFA-10 was not added to all gasoline sold in the San Francisco Bay Area in 1991. As additive injection systems were installed in third party terminals prior to CARB additive regulations taking effect in January, 1992, MFA-10 was introduced into gasolines distributed by Ultramar Inc. OGA 476PL was substituted for Tolad MFA-10 late in 1991.

OGA 476PL (MSDS and Product Data sheet included): Added to a portion of the gasolines distributed by Ultramar Inc. in the San Francisco Bay Area from 1991 - 1995. OGA 476PL is a multifuntional additive manufactured by Chevron Chemical Company, providing detergency and corrosion inhibition. This additive was injected into gasolines by computer controlled systems at terminal transport truck loading racks. OGA 476PL was not added to all gasoline sold in the San Francisco Bay Area from 1991 - 1995. OGA 476PL was replaced by Lubrizol 8195C in some gasolines supplied to the San Francisco Bay Area beginning in 1993 and replaced by OGA 477PL in other gasolines beginning in 1995. The maximum average dosage of OGA 476PL from a single supply terminal for a one month period between 1991 and 1995 was 877 mg/l.

Lubrizol 8195C (MSDS and Product Data sheet included): Added to a portion of the gasolines distributed by Ultramar Inc. in the San Francisco Bay Area from 1993 -1995. Lubrizol 8195C is a multifuntional additive manufactured by Lubrizol Corporation, providing detergency and corrosion inhibition. This additive was injected into gasolines by computer controlled systems at terminal transport truck loading racks. Lubrizol 8195C was not added to all

gasoline sold in the San Francisco Bay Area from 1993 - 1995. Lubrizol 8195C replaced OGA 476PL in some gasolines supplied to the San Francisco Bay Area beginning in 1993. Lubrizol 8195C was replaced by Lubrizol 8192S in 1995. The maximum average dosage of Lubrizol 8195C from a single supply terminal for a one month period between 1993 and 1995 was 528 mg/l.

OGA 477PL (MSDS and Product Data sheet included): Added to a portion of the gasolines distributed by Ultramar Inc. in the San Francisco Bay Area from 1995 - 1996. OGA 477PL is a multifuntional additive manufactured by Chevron Chemical Company, providing detergency and corrosion inhibition. This additive was injected into gasolines by computer controlled systems at terminal transport truck loading racks. OGA 477PL was not added to all gasoline sold in the San Francisco Bay Area from 1995 - 1996. OGA 477PL was gradually replaced by Lubrizol 8192S in gasolines supplied to the San Francisco Bay Area during 1995 and 1996. The maximum average dosage of OGA 477PL from a single supply terminal for a one month period between 1995 and 1996 was 483 mg/l.

Lubrizol 8192S (MSDS included): Added to a portion of the gasolines distributed by Ultramar Inc. in the San Francisco Bay Area from 1995 - 1997. Lubrizol 8192S is a multifuntional additive manufactured by Lubrizol Corporation, providing detergency and corrosion inhibition. This additive was injected into gasolines by computer controlled systems at terminal transport truck loading racks. Lubrizol 8192S was not added to all gasoline sold in the San Francisco Bay Area from 1995 - 1997. Lubrizol 8192S replaced Lubrizol 8195C in some gasolines supplied to the San Francisco Bay Area beginning in 1995 and gradually replaced OGA 477PL in other gasolines supplied to the San Francisco Bay Area during 1995 and 1996. Lubrizol 8192S was replaced by Lubrizol 8247E in 1997. The maximum average dosage of Lubrizol 8192S from a single supply terminal for a one month period between 1995 and 1997 was 321 mg/l.

Lubrizol 8247E (MSDS and Product Data sheet included): Added to a portion of the gasolines distributed by Ultramar Inc. in the San

Francisco Bay Area during 1997. Lubrizol 8247E is a multifuntional additive manufactured by Lubrizol Corporation, providing detergency and corrosion inhibition. This additive is injected into gasolines by computer controlled systems at terminal transport truck loading racks. Lubrizol 8192S was not added to all gasoline sold in the San Francisco Bay Area during 1997. Lubrizol 8247E replaced Lubrizol 8195C in some gasolines supplied to the San Francisco Bay Area in 1997. The maximum average dosage of Lubrizol 8247E from a single supply terminal for a one month period through the second quarter of 1997 was 184 mg/l.

Purchased/Exchanged Gasolines

In the oil industry, it is a common practice for companies to supply gasolines to end use customers that they do not manufacture in their own refineries in order to reduce logistic expenses. These gasolines may either be purchased from another company or procured through an "exchange". An exchange is a reciprocal agreement to supply equivalent volumes of similar quality products to each other in agreed upon locations. The specifications governing the products exchanged are agreed upon in advance and are usually based on industry standards and/or regulatory requirements.

Additives were not often addressed in the exchange agreements prior to 1992. Therefore, companies such as Ultramar Inc. have little specific information about individual additives included in gasolines received from other companies through purchases or exchanges prior to 1992. A good example of lack of specific information is the leaded gasoline supplied in the San Francisco Bay Area by Ultramar Inc. prior to the prohibition of leaded gasoline by CARB regulation in 1992. We know that leaded gasoline provided to us through purchases or exchanges had lead contents potentially ranging from about 0.1 grams/gallon Pb to a maximum of 4.23 grams/gallon Pb. We do not know exact organic lead compound used (tetraethyl lead, tetramethyl lead, or a mixture of both), the supplier, or the brand name of the additive used to produce the gasoline we received for distribution.

Another example is oxygenated compounds, such as MTBE. Prior to 1992, unless a gasoline was intended for blending with ethanol or unless specifically

addressed in the purchase or exchange agreement, gasoline manufacturers were not required to disclose the use of oxygenates. Even today, gasolines are typically exchanged on the basis of minimum oxygen content and in the San Francisco Bay Area may contain from 0 - 2.7 wt% oxygen from February to October and 1.8 to 2.7 wt% oxygen from November - January. The type and amount of the oxygenate is typically not disclosed. Although we cannot provide detailed information about other oxygenates that may have been used in gasolines we received through purchases or exchanges, we have included MSDS data for MTBE in the attachments.

We do have limited information from our suppliers about detergent additives included in purchased or exchanged gasolines. The following additives have been used in gasolines supplied to Ultramar Inc. for distribution in the San Francisco Bay Area:

Exchange Gasoline Additives, 1992 - 1997

Supplier	Additive Name
Exxon	OGA 476TU, OGA 400EX
Shell	OGA 400DC, Lubrizol 8192S, Lubrizol 8247E

Dosage rates of these additives would best be supplied by the companies themselves and will likely be included in their response to your current request for information.

Methodologies for Determining Additives in Soil and Water

Ultramar Inc. has no unique proprietary methods for identfying or quantifying fuel additives in soil or water. As indicated in your letter, oxygenates can be readily measured at the ppb level in groundwater using Federally approved test methods. While manufacturers of detergent additives must submit to CARB methods for measuring the additive concentration in fuels as part of the certification process, questions about methods for measuring the detergent additives (typically high molecular weight poly-isobutene amines in a mineral

oil carrier fluid) would best be answered by the additive manufacturers. We will provide contacts with additive suppliers at your request.

Other Sources of Information

If one purpose of this information gathering process is to define the universe of potential compounds that might be added to gasolines, the best source for such information might be the Office of Fuel and Fuel Additive Registration. The Office maintains lists of all additives approved for use in transportation fuels. The address is:

U. S. EPA
Office of Fuel and Fuel Additive Registration
401 M Street, SW
Mail Code 64-06J
Washington, DC, 20460.

Lists of certified deposit control additives are maintained by the CARB staff administered through the Stationary Source Division, Fuels Section. The address is:

California Environmental Protection Agency
Air Resources Board
Stationary Source Division
Fuels Section
2020 L Street
P.O. Box 2815
Sacramento, CA 95814

Further Information

The information included in this report is accurate and complete to the best of our knowledge. We will provide further information or clarification of information included in this report at your request.

EXHIBIT 13

MATERIAL SAFETY DATA SHEET ULTNA163 Page 001 of 015

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

ULTRAMAR, INC.
SAFETY AND LOSS CONTROL DEPARTMENT
24-HOUR EMERGENCY TELEPHONE NUMBER

P.O. BOX 93102
LONG BEACH, CALIFORNIA 90809-3102
(310) 491-6795 OR (310) 435-5832

SUBSTANCE: UNLEADED GASOLINE WITH MTBE

TRADE NAMES/SYNONYMS:
ULTNA163

CHEMICAL FAMILY:
Mixture

CREATION DATE: 02/16/93 REVISION DATE: 06/30/94

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT: GASOLINE, AUTOMOTIVE, UNLEADED
CAS NUMBER: 8006-61-9
PERCENTAGE: 85-90

COMPONENT: METHYL TERT-BUTYL ETHER
CAS NUMBER: 1634-04-4
PERCENTAGE: 10-15

COMPONENT: BENZENE
CAS NUMBER: 71-43-2
PERCENTAGE: >0.1

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=0 PERSISTENCE=1
NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=3 REACTIVITY=0

EMERGENCY OVERVIEW:
Clear, colorless to amber, aromatic, volatile liquid.
Cancer hazard (contains material which can cause cancer in humans). Risk of cancer depends on duration and level of exposure. Causes respiratory tract, skin and eye irritation. May cause blood disorders. May cause convulsions. May damage nerves. May affect the central nervous system. May cause adverse reproductive effects. May cause brain damage. May cause hearing loss. May affect the heart. May affect the kidneys. May affect the liver. May damage the lungs. May cause visual disturbances. Flammable liquid and vapor. May cause flash fire.
Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Keep away from all ignition sources. Keep container tightly closed. Wash thoroughly after handling. Use only with adequate ventilation. Handle with caution.

POTENTIAL HEALTH EFFECTS:
INHALATION:

SHORT TERM EFFECTS: May cause irritation. Additional effects may include paleness, flushing, ringing in the ears, lack of appetite, nausea, vomiting, difficulty speaking, difficulty swallowing, chest pain, difficulty breathing, irregular heartbeat, headache, weakness, drowsiness, drunkeness, feeling of well-being, confusion, disorientation, nervousness, restlessness, sleeplessness, numbness, twitching, visual disturbances, suffocation, lung damage, blood disorders, nerve effects, paralysis, convulsions, shock, unconsciousness and coma.
LONG TERM EFFECTS: In addition to effects from short term exposure, weight loss, low blood pressure, loss of memory, hearing loss, bruising, kidney damage, nerve damage and brain damage may occur. May also cause reproductive effects and cancer.

SKIN CONTACT:
SHORT TERM EFFECTS: May cause irritation. Additional effects may include blisters, blood in the urine, low blood pressure, lung damage and kidney damage.
LONG TERM EFFECTS: In addition to effects from short term exposure, burns, tingling sensation and nerve effects may occur.

EYE CONTACT:
SHORT TERM EFFECTS: May cause irritation. Additional effects may include spastic winking.
LONG TERM EFFECTS: In addition to effects from short term exposure, cataracts may occur.

INGESTION:
SHORT TERM EFFECTS: May cause gastrointestinal irritation. Additional effects may include coughing, paleness, flushing, fever, nausea, vomiting, diarrhea, chest pain, difficulty breathing, irregular heartbeat, headache, weakness, drunkeness, feeling of well-being, confusion, disorientation, nervousness, restlessness, excitation or drowsiness, twitching, visual disturbances, bluish skin color, suffocation, lung damage, liver damage, paralysis, convulsions, unconsciousness, coma and heart failure.
LONG TERM EFFECTS: In addition to effects from short term exposure, anemia and impotence may occur. May also cause reproductive effects and cancer.

CARCINOGEN STATUS:
OSHA: Y
NTP: Y
IARC: Y

SECTION 4 FIRST AID MEASURES

INHALATION:
FIRST AID- Remove from exposure area to fresh air immediately. Perform artificial respiration if necessary. Maintain airway, blood pressure and respiration. Keep warm and at rest. Treat symptomatically and supportively. Get medical attention immediately. Qualified medical personnel should consider administering oxygen.

SKIN CONTACT:
FIRST AID- Remove contaminated clothing and shoes immediately. Wash with soap or mild detergent and large amounts of water until no evidence of chemical remains (at least 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline. occasionally lifting upper and lower lids, until no evidence of chemical remains (at least 15-20 minutes). Get medical attention immediately.

INGESTION:
FIRST AID- Treat symptomatically and supportively. Get medical attention immediately. Maintain airway, blood pressure and respiration. If vomiting occurs, keep head lower than hips to help prevent aspiration. Do not give anything by mouth or induce vomiting if person is unconscious or otherwise unable to swallow. If a poisonous substance has been ingested, it is generally suggested to proceed with the following: Induce emesis. Qualified medical personnel should consider the following: Perform gastric lavage (if there is no sign of perforation or corrosive injury). If a corrosive substance has been ingested and perforation has not occured, it is generally suggested to proceed with the following: Rinse mouth with water. Give milk or water.

SECTION 5 FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARD:
Dangerous fire hazard when exposed to heat or flame.

Vapors are heavier than air and may travel a considerable distance to a source of ignition and flash back.

Vapor-air mixtures are explosive.

EXTINGUISHING MEDIA:
Dry chemical, carbon dioxide, water spray or regular foam (1993 Emergency Response Guidebook, RSPA P 5800.6).

For larger fires, use water spray, fog or regular foam (1993 Emergency Response Guidebook, RSPA P 5800.6).

FIREFIGHTING:
Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire. Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire (1993 Emergency Response Guidebook, RSPA P 5800.6, Guide Page 27).

Extinguish only if flow can be stopped; use water in flooding amounts as fog, solid streams may spread fire. Cool containers with flooding amounts of water. apply from as far a distance as possible. Avoid breathing vapors, keep upwind. Evacuate to a radius of 1500 feet for uncontrollable fires. Consider evacuation of downwind area if material is leaking.

Water may be ineffective (NFPA 325M, Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids, 1991)

FLASH POINT: -45 F (-43 C) (CC)
LOWER FLAMMABLE LIMIT: 1.2%
UPPER FLAMMABLE LIMIT: 7.6%
AUTOIGNITION: 536-853 F (286-456 C)
FLAMMABILITY CLASS(OSHA): IB

HAZARDOUS COMBUSTION PRODUCTS:
Thermal decomposition products may include toxic oxides of carbon.

SECTION 6 ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL SPILL:
Shut off ignition sources. Stop leak if you can do it without risk. Use water spray to reduce vapors. For small spills, take up with sand or other absorbent material and place into containers for later disposal. For larger spills, dike far ahead of spill for later disposal. No smoking, flames or flares in hazard area. Keep unnecessary people away; isolate hazard area and restrict entry.

Reportable Quantity (RQ):
The Superfund Amendments and Reauthorization Act (SARA) Section 304 requires that a release equal to or greater than the reportable quantity established for that substance be immediately reported to the local emergency planning committee and the state emergency response commission (40 CFR 355.40). If the release of this substance is reportable under CERCLA Section 103, the National Response Center must be notified immediately at (800) 424-8802 or (202) 426-2675 in the metropolitan Washington, D.C. area (40 CFR 302.6).

WATER SPILL:
The California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) prohibits contaminating any known source of drinking water with substances known to cause cancer and/or reproductive toxicity.

SECTION 7 HANDLING AND STORAGE

Observe all federal, state and local regulations when storing this substance.

Store in accordance with 29 CFR 1910.106.

Bonding and grounding: Substances with low electroconductivity, which may be ignited by electrostatic sparks, should be stored in containers which meet the bonding and grounding guidelines specified in NFPA 77-1983, Recommended Practice on Static Electricity.

Store away from incompatible substances.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

EXPOSURE LIMITS:
GASOLINE (BULK HANDLING):
300 ppm (900 mg/m3) OSHA TWA; 500 ppm (1,500 mg/m3) OSHA STEL
300 ppm (900 mg/m3) ACGIH TWA; 500 ppm (1,500 mg/m3) ACGIH STEL

BENZENE:

1 ppm OSHA TWA; 5 ppm OSHA 15 minute STEL; 0.5 ppm OSHA action level
10 ppm (30 mg/m3) ACGIH TWA;
ACGIH A2-Suspected Human Carcinogen
(Notice of Intended Changes 1990-91)
0.1 ppm (0.32 mg/m3) NIOSH recommended 8 hour TWA;
1 ppm (3.2 mg/m3) NIOSH recommended 15 minute ceiling

Measurement method: Charcoal tube; carbon disulfide; gas chromatography with flame ionization detection; (NIOSH Vol. III # 1500, Hydrocarbons).

10 pounds CERCLA Section 103 Reportable Quantity
Subject to SARA Section 313 Annual Toxic Chemical Release Reporting
Subject to California Proposition 65 cancer and/or reproductive toxicity warning and release requirements- (February 27, 1987)

OSHA revoked the final rule limits of January 19, 1989 in response to the 11th Circuit Court of Appeals decision (AFL-CIO v. OSHA) effective June 30, 1993. See 29 CFR 1910.1000 (58 FR 35338)

METHYL TERT-BUTYL ETHER:
40 ppm (140 mg/m3) ACGIH TWA (proposed addition 1993-94)

Subject to SARA Section 313 Annual Toxic Chemical Release Reporting

VENTILATION:
Provide local exhaust or general dilution ventilation to meet published exposure limits. Ventilation equipment should be explosion-proof if explosive concentrations of dust, vapor or fume are present.

EYE PROTECTION:
Employee must wear splash-proof or dust-resistant safety goggles to prevent eye contact with this substance.

Emergency eye wash: Where there is any possibility that an employee's eyes may be exposed to this substance, the employer should provide an eye wash fountain within the immediate work area for emergency use.

CLOTHING:
Employee must wear appropriate protective (impervious) clothing and equipment to prevent repeated or prolonged skin contact with this substance.

Any clothing wet with a flammable liquid should be immediately removed at the location where it is wetted to prevent burns from possible ignition.

GLOVES:
Employee must wear appropriate protective gloves to prevent contact with this substance.

RESPIRATOR:
The following respirators are recommended based on information found in the physical data, toxicity and health effects sections. They are ranked in order from minimum to maximum respiratory protection.
The specific respirator selected must be based on contamination levels found in the work place, must be based on the specific operation, must not exceed the working limits of the respirator and must be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety

and Health Administration (NIOSH-MSHA).

Any chemical cartridge respirator with organic vapor cartridge(s) and a full facepiece.

Any gas mask with organic vapor canister (chin-style or front- or back-mounted canister), with a full facepiece.

Any type 'C' supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet or hood operated in a continuous-flow mode.

Any self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: Clear, colorless to amber, aromatic, volatile liquid.
BOILING POINT: 100-400 F (38-204 C)
VAPOR PRESSURE: not available
VAPOR DENSITY: 3.0-4.0
SPECIFIC GRAVITY: 0.7-0.8
WATER SOLUBILITY: insoluble
ODOR THRESHOLD: 0.25 ppm
SOLVENT SOLUBILITY: Absolute alcohol, ether, chloroform, benzene

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY:
Stable under normal temperatures and pressures.

CONDITIONS TO AVOID:
Avoid contact with heat, sparks, flames, or other sources of ignition. Vapors may be explosive. Avoid overheating of containers; containers may violently rupture in heat of fire. Avoid contamination of water sources.

INCOMPATIBILITIES:
GASOLINE, AUTOMOTIVE, UNLEADED:
OXIDIZERS (STRONG): Fire and explosion hazard.

METHYL TERT-BUTYL ETHER:
ACIDS (STRONG): Incompatible.
BASES (STRONG): Incompatible.

OXIDIZERS (STRONG): Fire and explosion hazard.
See also ethers.

ETHERS:
BORON TRIIODIDE: Vigorous reaction.

BENZENE:
ACIDS (STRONG): Incompatible.
ALLYL CHLORIDE WITH DICHLOROETHYL ALUMINUM OR ETHYLALUMINUM SESQUICHLORIDE: Possible explosion.
ARSENIC PENTAFLUORIDE + POTASSIUM METHOXIDE: Explosive interaction.
BASES (STRONG): Incompatible.
BROMINE + IRON: Incompatible.
BROMINE PENTAFLUORIDE: Fire and explosion hazard.
BROMINE TRIFLUORIDE: Possible explosion or ignition.
CHLORINE: Explosion in the presence of light.
CHLORINE TRIFLUORIDE: Violent reaction with possible explosion.
CHROMIC ANHYDRIDE (POWDERED): Ignition.
DIBORANE: Spontaneously explosive reaction in air.
DIOXYGEN DIFLUORIDE: Ignition; even at reduced temperatures.
DIOXYGENYL TETRAFLUOROBORATE: Ignition reaction.
INTERHALOGEN COMPOUNDS: Ignition or explosion.
IODINE HEPTAFLUORIDE: Ignition on contact.
IODINE PENTAFLUORIDE: Violent interaction above 50 C.
NITRIC ACID: Violent or explosive unless properly agitated and cooled.
NITRYL PERCHLORATE: Explosive interaction.
OXIDIZERS (STRONG): Fire and explosion hazard.
OXYGEN (LIQUID): Explosive mixture.
OZONE: Formation of explosive gelatinous ozonide.
PERCHLORATES (METAL): Formation of explosive complex.
PERCHLORYL FLUORIDE + ALUMINUM CHLORIDE: Formation of shock sensitive compound.
PERMANGANATES + SULFURIC ACID: Possible explosion.
PERMANGANIC ACID: Explosion hazard.
PEROXODISULFURIC ACID: Explosion hazard.
PEROXOMONOSULFURIC ACID: Explosive interaction.
POTASSIUM PEROXIDE: Ignition.
SILVER PERCHLORATE: Formation of explosive complex.
SODIUM PEROXIDE + WATER: Ignition.
URANIUM HEXAFLUORIDE: Violent reaction.

HAZARDOUS DECOMPOSITION:
Thermal decomposition products may include toxic oxides of carbon.

POLYMERIZATION:
Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11 TOXICOLOGY INFORMATION

GASOLINE, AUTOMOTIVE, UNLEADED:
(Data derived from unspecified and unleaded gasoline)
IRRITATION DATA: 500 mg/24 hours skin-rabbit mild; 500 ppm/1 hour eye-man moderate; 140 ppm/8 hours eye-human mild.
TOXICITY DATA: 900 ppm/1 hour inhalation-man TCLo; 300 gm/m3/5 minutes

inhalation-rat LC50; 300 gm/m3/5 minutes inhalation-mouse LC50; 300 gm/m3/5 minutes inhalation-guinea pig LC50; 30000 ppm/5 minutes inhalation-mammal LCLo; 18,000 mg/kg oral-rat LD50; 13.6 gm/kg oral-rat LD50 (AETODY); 53 mg/kg parenteral-man TDLo; tumorigenic data (RTECS).
CARCINOGEN STATUS: Human Inadequate Evidence, Animal Limited Evidence (IARC Group-2B). In studies with mice and rats by inhalation, an increased incidence of hepatocellular adenomas and carcinomas was produced in female but not male mice; an increased incidence of adenomas and carcinomas of the kidney was produced in male but not female rats.
LOCAL EFFECTS: Irritant- inhalation, skin, eye.
ACUTE TOXICITY LEVEL: Relatively non-toxic by inhalation and ingestion.
TARGET EFFECTS: Central nervous system depressant; simple asphyxiant.
ADDITIONAL DATA: The use of alcoholic beverages enhances the toxic effects. Stimulants such as epinephrine may induce ventricular fibrillation.

BENZENE:
IRRITATION DATA: 20 mg/24 hours skin-rabbit moderate; 15 mg/24 hours open skin-rabbit mild; 88 mg eye-rabbit moderate; 2 mg/24 hours eye-rabbit severe.
TOXICITY DATA: 2000 ppm/5 minutes inhalation-human LCLo; 2 pph/5 minutes inhalation-human LCLo; 65 mg/m3/5 years inhalation-human LCLo; 100 ppm inhalation-human TCLo; 150 ppm/1 year intermittent inhalation-man TCLo; 10000 ppm/7 hours inhalation-rat LC50; 300 ppm/6 hours/13 weeks intermittent inhalation-rat TCLo; 300 ppm/6 hours/99 weeks intermittent inhalation-rat TCLo; 9980 ppm inhalation-mouse LC50; 103 ppm/6 hours/5 days intermittent inhalation-mouse TCLo; 221 ppm/6 hours/7 days intermittent inhalation-mouse TCLo; 48 ppm/6 hours/14 days intermittent inhalation-mouse TCLo; 10 ppm/6 hours/10 weeks intermittent inhalation-mouse TCLo; 300 ppm/6 hours/13 weeks intermittent inhalation-mouse TCLo; 300 ppm/6 hours/16 weeks intermittent inhalation-mouse TCLo; 302 ppm/6 hours/26 weeks intermittent inhalation-mouse TCLo; 100 ppm/6 hours/72 weeks intermittent inhalation-mouse TCLo; 146000 mg/m3 inhalation-dog LCLo; 170000 mg/m3 inhalation-cat LCLo; 45000 ppm/30 minutes inhalation-rabbit LCLo; 20000 ppm/5 minutes inhalation-mammal LCLo; >9400 mg/kg skin-rabbit LD50; >9400 mg/kg skin-guinea pig LD50; 50 mg/kg oral-man LDLo; 930 mg/kg oral-rat LD50; 6600 mg/kg/27 weeks intermittent oral-rat TDLo; 4700 mg/kg oral-mouse LD50; 2 gm/kg oral-dog LDLo; 88 mg/kg intravenous-rabbit LDLo; 1400 mg/kg subcutaneous-frog LDLo; 2890 ug/kg intraperitoneal-rat LD50; 340 mg/kg intraperitoneal-mouse LD50; 527 mg/kg intraperitoneal-guinea pig LDLo; 1500 mg/kg intraperitoneal-mammal LDLo; 194 mg/kg unreported-man LDLo; mutagenic data (RTECS); reproductive effects data (RTECS); tumorigenic data (RTECS).
CARCINOGEN STATUS: OSHA Carcinogen; Known Human Carcinogen (NTP); Human Sufficient Evidence, Animal Sufficient Evidence (IARC Group-1). Numerous case reports and series have suggested a relationship between exposure to benzene and the occurrence of various types of leukemia. Several case-control studies have also shown increased odds ratios for exposure to benzene, but mixed exposure patterns and poorly defined exposures render their interpretation difficult. Three independent cohort studies have demonstrated an increased incidence of acute nonlymphocytic leukemia in workers exposed to benzene.
LOCAL EFFECTS: Irritant- inhalation, skin, eye.
ACUTE TOXICITY LEVEL: Moderately toxic by inhalation and ingestion; slightly toxic by dermal absorption.
TARGET EFFECTS: Central nervous system depressant; bone marrow depressant. Poisoning may also affect the immune system and the heart.
AT INCREASED RISK FROM EXPOSURE: Persons with certain immunological

tendencies, poor nutrition, anemia and drug or chemically induced agranulocytamia.
ADDITIONAL DATA: Use of alcoholic beverages may enhance the toxic effects. Use of stimulants such as epinephrine may cause cardiac arrhythmias. May cross the placenta. Interactions with medications have been reported.

METHYL TERT-BUTYL ETHER:
TOXICITY DATA: 85 mg/L inhalation-rat LC50 (38MKAJ); 23,576 ppm/4h inhalation-rat LC50; 141 mg/m3/15 minutes inhalation-mouse LC50; >7405 mg/kg skin-rabbit LD50 (38MKAJ); 2962 mg/kg oral-rat LD50 (38MKAJ); 4 gm/kg oral-rat LD50.
CARCINOGEN STATUS: None.
ACUTE TOXICITY LEVEL: Moderately toxic by ingestion and inhalation; slightly toxic by dermal absorption.
TARGET EFFECTS: Central nervous system depressant.
AT INCREASED RISK FROM EXPOSURE: Persons with pre-existing skin disorders, eye problems or impaired respiratory function.

HEALTH EFFECTS
INHALATION:
GASOLINE, AUTOMOTIVE, UNLEADED:
IRRITANT/NARCOTIC/ASPHYXIANT/CARCINOGEN.
ACUTE EXPOSURE- At 160-270 ppm throat irritation may occur within several hours. At 2000 ppm mild anesthesia may occur within 30 minutes. Other symptoms of central nervous system depression may include headache, nausea, vomiting, dizziness, drowsiness, facial flushing, blurred vision, slurred speech, difficulty swallowing, staggering, confusion and euphoria. At higher levels dyspnea, pulmonary edema and bronchopneumonia may develop. Further depression may occur with weak respiration and pulse, nervousness, twitching, irritability, and ataxia. Severe intoxication may result in delirium, unconsciousness, coma, and convulsions with epileptiform seizures. The pupils may be constricted or, in comatose states, fixed and dilated or unequal; nystagmus may also occur. May also affect the liver, kidneys, spleen, brain, myocardium and pancreas. Death may be due to respiratory or circulatory failure or ventricular fibrillation. Extremely high concentration may cause asphyxiation.
CHRONIC EXPOSURE- With few exceptions, most of the reported effects of repeated inhalation are from intentional "sniffing" of gasoline rather than workplace exposure. Reported symptoms include headache, nausea, fatigue, anorexia and weight loss, pallor, dizziness, insomnia, memory loss, nervousness, confusion, muscular weakness and cramps, peripheral neuropathy, polyneuritis, and neurasthenia. It is unclear whether some of these symptoms may have been due to gasoline containing lead. Liver and and kidney damage are also possible. In a 90 day study, male but not female rats exhibited a severe, dose-related renal toxicity. In another study, an increase in renal adenomas and carcinomas in male rats and an increase in hepatocellular adenomas and carcinomas in female mice were reported.

BENZENE:
IRRITANT/NARCOTIC/BONE MARROW DEPRESSANT/CARCINOGEN.
ACUTE EXPOSURE- Concentrations of 3000 ppm may cause respiratory tract irritation; more severe exposures may result in pulmonary edema. Systemic effects are mainly on the central nervous system and depend on exposure time and concentration. No effects were noted at 25 ppm for 8 hours; signs of intoxication began at 50-150 ppm within 5 hours; at 500-1500 ppm

within 1 hour; were severe at 7500 ppm, within 30-60 minutes; and 20,000 ppm was fatal within 5-10 minutes. Effects may include nausea, vomiting, headache, dizziness, drowsiness, weakness, sometimes preceded by a brief period of exhilaration or euphoria, irritability, malaise, confusion, ataxia, staggering, weak, rapid pulse, chest pain and tightness with breathlessness, pallor, cyanosis of the lips and fingertips, and tinnitus. In severe exposures there may be blurred vision, shallow, rapid breathing, delirium, cardiac arrhythmias, unconsciousness, deep anesthesia, paralysis, and coma characterized by motor restlessness, tremors and hyperreflexia, sometimes preceded by convulsions. Recovery depends on the severity of exposure. Polyneuritis may occur and there may be persistent nausea, anorexia, muscular weakness, headache, drowsiness, insomnia, and agitation. Nervous irritability, breathlessness, and unsteady gait may persist for 2-3 weeks; a peculiar skin color and cardiac distress may persist for 4 weeks. Liver and kidney effects may occur, but are usually mild, temporary impairments. Chronosomal damage has been found after exposure to toxic levels. Although generally hematotoxicity is not a significant concern in acute exposure, delayed hematological effects, including anemia and thrombocytopenia, have been reported, as have petechial hemorrhages, spontaneous internal bleeding and secondary infections. In fatal exposures, death may be due to asphyxia, central nervous system depression, cardiac or respiratory failure and circulatory collapse, or occasionally, sudden ventricular fibrillation. It may occur within a few minutes to several hours, or cardiac arrythmia may occur at anytime within 24 hours. Also, death from central nervous system, respiratory or hemorrhagic complications may occur up to 5 days after exposure. Pathologic findings have included respiratory inflammation with edema and hemorrhage of the lungs, renal congestion, cerebral edema, and extensive petechial hemorrhages in the brain, pleurae, pericardium, urinary tract, mucous membranes, and skin.

CHRONIC EXPOSURE- Longterm exposure may cause symptoms referable to the central nervous, hematopoietic and immune systems. Early effects are vague and varied and may include headache, light-headedness, dizziness, nausea, anorexia, abdominal discomfort, and fatigue. Sore, dry throat, weakness, lethargy, malaise, drowsiness, nervousness, and irritability have also been reported. Later there may be dyspnea, pallor, slightly increased temperature, decreased blood pressure, rapid pulse, palpitations, and visual disturbances. Dizziness when cold water is placed in the ear and hearing impairment have been reported, as have diffuse cerebral atrophy associated with ataxia, tremors and emotional lability. Workers exposed to benzene in combination with other solvents have exhibited polyneuritis. Several case reports, one of them an acute exposure, suggest the possibility that systemic exposure may be associated with retrobulbar or optic neuritis. Occasionally hemorrhages in retina and conjunctiva occur and rarely neuroretinal edema and papilledema have accompanied the retinal hemorrhages. Hematological effects vary widely and may appear after a few weeks or many years of exposure or even many years after exposure has ceased. The degree of exposure below which no blood effects will occur cannot be established with certainty. In the early stages, there may be blood clotting defects due to morphological, functional and quantitative platelet alteration with resultant bleeding from the nose and gums, easy bruising and petechiae; leukopenia with predominant lymphocytopenia or neutropenia; and anemia which may be normochromic or macrocytic and hypochromic. Extramedullary hematopoiesis, splenomegaly, circulating immature marrow cells, and an initial increase in leukocytes, erythrocytes and platelets have also been reported.

The bone marrow may be hyper-, hypo- or normoplastic and does not always correlate with the peripheral blood picture. Also, the symptoms do not always parallel the laboratory findings. If treated at this stage, the effects appear reversible, although recovery may be protracted and there may be relapses. Decreased erythrocyte survival, hemolysis, capillary fragility, internal hemorrhages, iron metabolism disturbances, and hyperbilirubinemia have also been reported. Exposure to high levels for longer periods may result in aplasia and fatty degeneration of the bone marrow with pancytopenia. The most serious cases of aplastic anemia may be fatal due to hemorrhage and infection; death may occur within 3 months of diagnosis. Enormous variability in individual response, including non-dose-dependent aplasia, and the finding of eosinophilia suggests that, in some cases, the blood dyscrasia may partially be an allergic reaction. Numerous case reports and series have suggested a relationship between exposure to benzene and the occurrence of various types of leukemia. Several case-control studies have also shown increased odds ratios for exposure to benzene, but mixed exposure patterns and poorly defined exposures render their interpretation difficult. Three independent cohort studies have demonstrated an increased incidence of acute nonlymphocytic leukemia in workers exposed to benzene. Several studies have also suggested a link between occupational exposure and multiple myeloma and lymphoma, both Hodgkin's and nonhodgkin's. Although aplastic anemia is probably the more likely consequence of longterm exposure, it is not uncommon for an individual surviving this, to go through a preleukemic phase into frank leukemia. Conversely, leukemia without precedent aplastic anemia can occur. In one study the range of time from the start of the exposure to the diagnosis of leukemia was 3-24 years. It has been suggested that the chromosomal aberrations which can arise in peripheral blood and bone marrow cells and persist for a long time after exposure ceases, may be associated with the increased incidence of leukemia. The immunosuppressive effect has also been suggested as being associated with the leukemogenesis. Adverse effects on the immunological system have been shown to make rabbits more susceptible to tuberculosis and pneumonia and may explain why the terminal event in some cases of benzene intoxication may be overwhelming infection. Exposed mice exhibited a tendency toward induction of lymphoid neoplasms. Rats exhibited an increased incidence of neoplasms, mainly carcinomas, at various sites. Menstrual disturbances have been reported more frequently in exposed women. Testicular damage has been reported in rats, rabbits and guinea pigs. Some animal studies have demonstrated embryo/fetotoxicity, sometimes at levels as low as 10 ppm and the potential for teratogenic effects such as decreased body weight and skeletal variants, have also been shown. Other studies have not produced any abnormalities or embryolethality.

METHYL TERT-BUTYL ETHER:
NARCOTIC.

ACUTE EXPOSURE- May cause irritation to the mucous membranes. Headaches, dizziness, sleepiness, anesthetic effects, weakness of distal muscles, and central nervous system depression may result from over-exposure.

CHRONIC EXPOSURE- Subacute exposure to 1000 and 3000 ppm caused reduced reaction to auditory stimuli, histologic inflammation of the nasal mucosa and trachea, and increased liver weights in rats. Symptoms of acute exposure may be produced by repeated or prolonged inhalation.

SKIN CONTACT:
GASOLINE, AUTOMOTIVE, UNLEADED:
IRRITANT.
ACUTE EXPOSURE- Liquid may cause irritation with erythema and pain. Prolonged or extensive contact may cause blistering and, in extreme cases epidermal necrolysis. A 12 year old boy partially immersed in a pool of gasoline for 1 hour experienced hypotension, abdominal tenderness, disseminated intravascular coagulation, transient hematuria, nonoliguric renal failure and an elevated serum amylase. Autopsy revealed cerebral edema, diffuse bilateral pneumonia, biventricular cardiac enlargement, toxic nephrosis, fatty infiltration of liver and peripancreatic fat necrosis.
CHRONIC EXPOSURE- Repeated or prolonged contact with the liquid may cause irritation, dermatitis and defatting of the skin with drying and cracking or burns and blistering. Some individuals may develop hypersensitivity, probably due to additives.

BENZENE:
IRRITANT.
ACUTE EXPOSURE- Direct contact may cause irritation. Effects may include erythema, a burning sensation, and with prolonged contact, blistering and edema. Under normal conditions, significant signs of systemic toxicity are unlikely from skin contact alone due to the slow rate of absorption; it may however, contribute to the toxicity from inhalation. Application to guinea pigs resulted in increased dermal permeability.
CHRONIC EXPOSURE- Repeated or prolonged contact defats the skin and may result in dermatitis with erythema, scaling, dryness, vesiculation, and fissuring, possibly accompanied by parasthesias of the fingers which may persist several weeks after the dermatitis subsides. Peripheral neuritis has also been reported. Secondary infections may occur. Tests on guinea pigs indicate sensitization is possible. Although animal studies have failed to establish a relationship between skin contact and a carcinogenic effect, most of the studies were inadequate; some papillomas and hematopoietic effects have been reported.

METHYL TERT-BUTYL ETHER:
ACUTE EXPOSURE- May cause slight irritation. May be absorbed through the skin.
CHRONIC EXPOSURE- Repeated and prolonged contact may cause dermatitis due to the defatting action.

EYE CONTACT:
GASOLINE, AUTOMOTIVE, UNLEADED:
IRRITANT.
ACUTE EXPOSURE- Concentrations between 270 and 900 ppm may cause a sensation of irritation often before signs such as conjunctival hyperemia are visible. Liquid splashed in the eyes may cause pain, smarting and slight, transient corneal epithelial disturbance. Blepharospasm and conjunctival hyperemia and edema may occur.
CHRONIC EXPOSURE- Repeated or prolonged exposure may cause conjunctivitis and possible gradual, irreversible loss of corneal and conjunctival sensitivity.

BENZENE:
IRRITANT.
ACUTE EXPOSURE- May cause irritation. Vapor concentrations of 3000 ppm are very irritating, even on brief exposure. Droplets cause a moderate burning sensation, but only a slight, transient corneal epithelial injury with rapid recovery.
CHRONIC EXPOSURE- Repeated or prolonged exposure may cause conjunctivitis. 50% of rats exposed to 50 ppm for more than 600 hours developed cataracts.

METHYL TERT-BUTYL ETHER:
ACUTE EXPOSURE- Liquid and vapor may cause mild to moderate irritation and tissue damage.
CHRONIC EXPOSURE- Prolonged or repeated contact may cause effects detailed in acute exposure.

INGESTION:
GASOLINE, AUTOMOTIVE, UNLEADED:
NARCOTIC.
ACUTE EXPOSURE- May cause irritation and burning of the gastrointestinal tract with nausea, vomiting and diarrhea. Absorption may cause initial central nervous stimulation followed by depression. Symptoms may include a mild excitation, restlessness, nervousness, irritability, twitching, weakness, blurred vision, headache, dizziness, drowsiness, incoordination, confusion, delirium, unconsciousness, convulsions and coma. Cardiac arrythmias may occur. Transient liver damage is possible. Direct or indirect aspiration may cause chemical pneumonitis with pulmonary edema and hemorrhage, possibly complicated by bacterial pneumonia, and less frequently, by emphysema and pneumonthorax. Signs of pulmonary involvement may include coughing, dyspnea, substernal pain, sudden development of rapid breathing, cyanosis, tachycardia and fever. Even small amounts may be fatal with death caused by cardiac arrest, asphyxia or respiratory paralysis. Depending on amount aspirated, death may occur rapidly or within 24 hours.
CHRONIC EXPOSURE- No data available.

BENZENE:
NARCOTIC/CARCINOGEN.
ACUTE EXPOSURE- May cause local irritation and burning sensation in the mouth, throat and stomach, and hemorrhagic inflammatory lesions of the mucous membranes in contact with the liquid. Signs and symptoms of systemic intoxication may include nausea, vomiting, headache, dizziness, weakness, staggering, chest pain and tightness, shallow, rapid pulse and respiration, breathlessness, pallor followed by flushing, and a fear of impending death. There may be visual disturbances, tremors, convulsions, ventricullar irregularities, and paralysis. Excitement, euphoria or delirium may precede weariness, fatigue, sleepiness and followed by stupor and unconsciousness, coma and death from respiratory failure. Those who survive the central nervous system effects may develop bronchitis, pneumonia, pulmonary edema, and intrapulmonary hemorrhage. Aspiration may cause immediate pulmonary edema and hemorrhage. The usual lethal dose in humans is 10-15 milliliters, but smaller amounts have been reported to cause death. A single exposure may produce longterm effects with pancytopenia persisting up to a year.
CHRONIC EXPOSURE- Daily administration to humans of 2-5 grams in olive oil caused headache, vertigo, bladder irritability, impotence, gastric disturbances, and evidence of renal congestion. In female rats treated

with 132 single daily doses over 187 days, no effects were observed at 1 mg/kg; slight leukopenia at 10 mg/kg; and both leukopenia and anemia at 50 and 100 mg/kg. Oral administration to rats and mice at various dose levels induced neoplasms at multiple sites in males and females. In a one year gavage study, rats given 50 or 250 mg/kg, 4-5 days/week for 52 weeks did not exhibit acute or subacute toxic effects, but a dose correlated increase of leukemias and mammary carcinomas was observed; some other tumor types were also reported. Reproductive effects have been reported in animals.

METHYL TERT-BUTYL ETHER:
NARCOTIC.
ACUTE EXPOSURE- May cause gastrointestinal tract irritation and discomfort. If sufficient amounts are ingested, central nervous system depression may occur. Laryngeal, ocular, and respiratory muscles may be affected in severe poisoning.
CHRONIC EXPOSURE- Symptoms of acute exposure may be produced by chronic ingestion.

SECTION 12 ECOLOGICAL INFORMATION

ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

SECTION 13 DISPOSAL INFORMATION

Observe all federal, state and local regulations when disposing of this substance.

Disposal must be in accordance with standards applicable to generators of hazardous waste, 40 CFR 262. EPA Hazardous Waste Number D001.
100 pound CERCLA Section 103 Reportable Quantity.

Benzene - Regulatory level: 0.5 mg/l (TCLP-40 CFR 261 Appendix II) materials which contain the above substance at or above the TCLP regulatory level meet the EPA toxicity characteristic, and must be disposed of in accordance with 40 CFR part 262. EPA Hazardous Waste Number D018.

SECTION 14 TRANSPORTATION INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION SHIPPING NAME-ID NUMBER, 49 CFR 172.101:
Gasoline-UN 1203

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASS OR DIVISION, 49 CFR 172.101:
3 - Flammable liquid

U.S. DEPARTMENT OF TRANSPORTATION PACKING GROUP, 49 CFR 172.101:
PG II

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS, 49 CFR 172.101
AND SUBPART E:
Flammable liquid

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING AUTHORIZATIONS:
EXCEPTIONS: 49 CFR 173.150
NON-BULK PACKAGING: 49 CFR 173.202
BULK PACKAGING: 49 CFR 173.242

SECTION 15 REGULATORY INFORMATION

TSCA STATUS: Y

CERCLA SECTION 103 (40CFR302.4): Y
BENZENE: 10 pounds RQ
SARA SECTION 302 (40CFR355.30): N
SARA SECTION 304 (40CFR355.40): N
SARA SECTION 313 (40CFR370.65): Y
OSHA PROCESS SAFETY (29CFR1910.119): N
CALIFORNIA PROPOSITION 65: Y

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40 CFR 370.21)
ACUTE HAZARD: Y
CHRONIC HAZARD: Y
FIRE HAZARD: Y
REACTIVITY HAZARD: N
SUDDEN RELEASE HAZARD: N

SECTION 16 OTHER

EXHIBIT 14

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

In Re: Methyl Tertiary Butyl Ether ("MTBE") Products Liability Litigation — MDL 1358 (SAS)

This Document Relates To:

City of Fresno v. Chevron U.S.A. Inc., et al.
04 Civ. 04973

CHEVRON U.S.A. INC.'S SUPPLY DECLARATION

I, Frank G. Soler, declare:

1. I am Assistant Secretary for Defendant Chevron U.S.A. Inc. ("Chevron"). Chevron maintains electronic records of gasoline deliveries to retail gasoline stations. True and correct copies of printouts from these records are attached as Exhibits A through D. The column headings are defined as follows:

"Month/Year" is an accounting date for each transaction.

"Movement Type" means the type of transaction.

"Plant Name" lists the products terminal from which the gasoline was delivered.

"Trade Class" means the type of station to which it was delivered.

"Cust #/Facility #" means the distinct number assigned to each Chevron branded station.

"Customer Name" means the name of the dealer or operator at the facility.

"Operator #" means the distinct operator number assigned to each operator for a Chevron branded station.

"MOT" means method of transportation.

"Delivery Date" is the date of delivery.

"Invoice #" is a distinct number assigned to each delivery.

"Material" is the distinct code assigned to each type of gasoline refined by Chevron.

"Material Name" is the name of the product associated with the distinct product code.

"Quantity Gallons" is the amount of gasoline delivered in gallons.

"Quantity in Barrels" is the amount of gasoline delivered in barrels.

"City" is the name of the city in which the retail facility is located or a distinct code assigned to a particular city.

Based on information that is currently available, the following material codes and names represent products that Chevron can identify as having contained MTBE:

- 201058 - CALCO PUL CGAS W/ETHER;
- 201068 - CHEVRON SUP CGAS W/ETHER;
- 201088 - PUL CGAS W/ETHER;
- 201118 - CHEVRON UL CGAS W/ETHER ;
- 201135 - BASE TEST OPRG W/ETHER NV;
- 201158 - CALCO UL CGAS W/ETHER;
- 201188 - UL CGAS W/ETHER;
- 201208 - CHEVRON PLUS GAS W/ETHER;
- 201288 - MUL CGAS W/ETHER;
- 201308 - CHEV REGULAR GASO W/MTBE;
- 201358 - CALCO REGULAR GASO W/MTBE;
- 201388 - REGULAR GASOLINE W/MTBE; and
- 201458 - CALCO MUL CGAS WIETHER.

In addition, the following Material codes represent products that Chevron can identify as containing MTBE or TAME:

- 201272;
- 201275;

- 201278;
- 201261;
- 201264;
- 201267;
- 201211; and
- 201217.

2. I have reviewed Chevron's electronic records, and I am familiar with them. In particular, I have reviewed the electronic files to determine whether Chevron delivered gasoline to the sites identified in Plaintiff's discovery responses. Chevron's records reflect deliveries of gasoline to four of those sites and delivery to a jobber whom discovery in this case has revealed delivered some gasoline to two Chevron branded stations listed below.

3. **2740 North Van Ness.** Chevron supplied gasoline to the station located at 2740 North Van Ness from prior to the relevant time period until August 1986. Subsequently, on information and belief, R.V. Jensen delivered gasoline refined by Chevron to this site between 1986 and 1999. For time period of January 1986 until August 1986, the dates and amounts of sales to this site, including a material code and name for each sale, are set forth in the print-out attached to this declaration as Exhibit A. During that time period, Chevron supplied this station with gasoline from a terminal located in Fresno, California. Between 1986 and 1999, Chevron supplied gasoline to R.V. Jensen. Chevron's sales to R.V. Jensen during that time period at the terminals in Richmond, Bakersfield, Banta, and Fresno are set forth in Exhibit E-1 and E-2. After selling the gasoline reflected in Exhibit E-1 and E-2 to R.V. Jensen, Chevron no longer owned the gasoline and did not have control over where the gasoline was delivered. Chevron supplied this station and R.V. Jensen with gasoline refined at its Richmond Refinery. Chevron's Richmond California refinery ("Richmond Refinery") began using MTBE as an octane enhancer in certain premium grades, on an as-needed basis, in 1990.

In 1992, Chevron began using MTBE at the Richmond Refinery during the wintertime months for purposes of meeting the oxygenate requirements mandated by the 1990 Clean Air Act Amendments. Then, in January 1995, Chevron began adding MTBE to gasoline manufactured at the Richmond Refinery on a year round basis to comply with the Clean Air Act's Reformulated Gasoline Program. Chevron notes that certain areas of Northern California did not have an oxygenate requirement, and that Chevron did not blend MTBE into all of the gasoline manufactured at its Richmond Refinery during the relevant time period. In 2003, Chevron stopped using MTBE at the Richmond Refinery and completed its transition from MTBE to ethanol in Northern California. Chevron's deliveries of gasoline to this station prior to 1990 did not contain MTBE. Chevron did not own the real estate or the USTs at this site, nor did it operate this site during the relevant time period. The RWQCB granted case closure for this site on September 2, 2008, stating that "necessary remediation has been completed at this site", "groundwater monitoring data suggests that no significant groundwater impact remains from the gasoline release at this site", and "residual petroleum hydrocarbons may be expected to attenuate naturally by the action of naturally-occurring soil bacteria".

4. **225 North H Street.** Chevron supplied gasoline to the station located at 225 North H Street from prior to the relevant time period until October 1990. Subsequently, on information and belief, R.V. Jensen delivered gasoline refined by Chevron to this site between October 1990 and 2003. The dates and amounts of sales to this site between 1986 and October 1990, including a material code and name for each sale, are set forth in the print-out attached to this declaration as Exhibit B. During that time period, Chevron supplied this station with gasoline from terminals located in Richmond, Bakersfield, Banta, and Fresno, California. Between October 1990 and 2003, Chevron supplied gasoline to R.V. Jensen. Chevron's sales to R.V. Jensen during that time period at the terminals in Richmond, Bakersfield, Banta, and Fresno are set forth in Exhibit E-1 and E-2. After selling the gasoline in Exhibit E-1 and E-2 to R.V. Jensen,

Chevron no longer owned the gasoline and did not have control over where the gasoline was delivered. Chevron supplied this station and R.V. Jensen with gasoline refined at its Richmond Refinery. Chevron did not blend MTBE into gasoline at the Richmond Refinery prior to 1990. Therefore, Chevron's gasoline supplied to this station prior to 1990 did not contain MTBE. Chevron stopped using MTBE at the Richmond Refinery in 2003. Thus, gasoline refined by Chevron that may have been supplied to this station after that time did not contain MTBE. Chevron did not own the real estate or the USTs at this site, nor did it operate this site during the relevant time period. Three underground storage tanks were excavated and removed from this site in 1999. FCDEH-FRESNO-004641. Environmental consultants investigating the site in 1999 concluded that the "site does not appear to pose a risk to groundwater". FCDEH-FRESNO-004641. In March 2000, the County of Fresno issued a no further action letter for this site.

5. **5756 North 1st Street.** Chevron supplied gasoline to this site from prior to the relevant time period until June 1988. Chevron terminated its dealer supply contract with this station on May 31, 1988, and did not supply gasoline to the subject site after that time. The dates and amounts of sales to this site, including a material code and name for each sale, are set forth in the print-out attached to this declaration as Exhibit C. Chevron supplied this station with gasoline from terminals located in Richmond, Bakersfield, Banta, and Fresno, California. Chevron supplied this station with gasoline refined at its Richmond Refinery. Chevron did not blend MTBE into gasoline at the Richmond Refinery prior to 1990. Therefore, the gasoline that Chevron supplied to this station did not contain MTBE. Chevron owned the USTs at the subject site from prior to the relevant time period until June 1988, when they were removed. Chevron did not own the land at the subject site during the relevant time period. After removal of the tanks from this site, Chevron assessed and remediated this site. On May 23, 1996, Fresno County Health Services Agency advised Chevron that:

A. The leak has been stopped and ongoing sources have been removed.
B. The site has been adequately characterized.
C. Little or no groundwater impact currently exists.
D. No water wells, deeper drinking water aquifers, surface water, or other sensitive receptors are likely to be impaired.
E. The site poses no significant risk to human health.
F. The site poses no significant risk to the environment.

CHEVMDL1358_FRES_0000003252-54. On May 22, 1997 the County of Fresno's Health Services Agency advised Chevron that no further action was need in connection with this site. CHEVMDL1358_FRES_0000003330-32. Other than a single unconfirmed detection in 2003 at 0.54 ppb, MTBE has not been detected at this site.

6. **3996 Parkway Drive.** Chevron supplied gasoline to this site from prior to the relevant time period until 1998. During that time period, Chevron owned the USTs at the subject site. During the relevant time period, Chevron leased the real estate at this site from a third-party. Chevron did not own the real estate at this site during the relevant time period. The dates and amounts of sales to this site, including a material code and name for each sale, are set forth in the print-out attached to this declaration as Exhibit D-1 and D-2. Chevron supplied this station with gasoline from terminals located in Richmond, Bakersfield, Banta, Fresno, and San Jose California. Chevron supplied this station with gasoline refined at its Richmond Refinery. Chevron did not blend MTBE into gasoline at the Richmond Refinery prior to 1990. Therefore, Chevron's gasoline supplied to this station prior to 1990 did not contain MTBE. The RWQCB issued a no further action letter to Chevron for this site on May 14, 2002.

7. Based on Chevron's records it did not deliver gasoline to, supply, own, lease, or operate any of the other stations identified in Plaintiff's discovery responses.

8. No one person for Chevron knows all of the matters stated herein, and therefore this declaration was prepared with the assistance and advice of representatives of and counsel for, said Chevron upon whose assistance and advice I have relied. This

declaration is limited by the records and information still in existence, presently recollected and thus far discovered.

9. Chevron reserves the right to supplement or amend this declaration should new information become available.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Executed this 18th day of April, 2011, at San Ramon, California.

Frank G. Soler, Assistant Secretary

DMDP

Dealer
Management
Development
Program

UNIT 5

HEALTH, SAFETY & ENVIRONMENT

PARTICIPANT GUIDE

Class Session 1:
THE HS&E & MSDS MANUALS

MSDS MANUAL CONTENTS

1. MSDS User's Guide
2. Individual Material Safety Data Sheets

Shell Products

- Fuels
- Motor Oils
- Transmission Fluid/Antifreeze
- Shell Specialty Products
- Other

Non-Shell Products

- Industrial Cleaners
- Car Wash Chemicals
- Other

Class Session 1:
THE HS&E & MSDS MANUALS

MANUAL LOOK UP ACTIVITY

HS&E Manual Situations

Situation	Problem
1 HS&E Manual	Your Shell Representative is making a routine check of your inventory control system. What are the requirements? Answer:
2 HS&E Manual	An OSHA inspector has just left your station. Is this incident reportable to Shell? Answer:
3 HS&E Manual	Your local Fire Marshal has just given you a copy of the National Electric Code. Where do you look to find out what it's for and where could you file the copy? Answer:
4 HS&E Manual	An employee asks you what tools there are to clean up a spill. The employee asks you what they are. What do you tell him? Answer:

Class Session 2:
INVENTORY SCRAMBLE

INVENTORY CONTROL SCRAMBLE ACTIVITY – PART 2

Inventory Control Scramble Activity – Part 2 Job Aid

WHY If Lessee Dealer's tolerance exceeds ...	WHO ...report it to...	WHEN ...within...
+/– 300 gallons in one day	Shell Representative	immediately notify by phone
+/– 150 gallons in per day over three consecutive days (either all gains or all losses)	Shell Representative	immediately notify by phone
+/– one-half of 1% of sales for any 30-day period	Shell Representative	immediately notify by phone
+/– general trend over any time period	Shell Representative	immediately notify by phone
suspect a product loss or question an inventory discrepancy	Shell Representative	immediately notify by phone
130 gallons + 1% of sales for any 30-day period	Shell Representative who will report it to Federal Agency	24 hours
25 gallons or more for any spill or overfill	Shell Representative who will report it to Federal, State, Local Agency & Fire Department	24 hours
less than 25 gallons if it is not immediately contained or cleaned up	Shell Representative who will report it to Federal, State, Local Agency & Fire Department	24 hours
underground storage tank: • has a suspected release or • has a confirmed release	Shell Representative who will report it to Federal Agency	24 hours

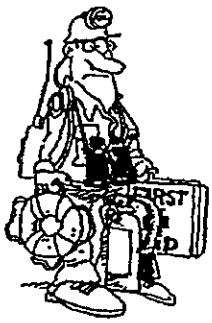
Class Session 3:
SESSION INTRODUCTION

EMERGENCY RESPONSE INTRODUCTION

You Will Learn

LOOK

- How you can prepare for emergencies
- The purpose, elements and procedures for HAZWOPER
- HAZWOPER training requirements



- How to label power switches and breakers
- How to report health & safety incidents to Shell and OSHA
- How to comply with HAZCOM requirements

Class Session 3:
HAZWOPER

PROGRAM REQUIREMENTS

HAZWOPER Program Requirements

1. Develop/have written emergency evacuation plan
2. Communicate any request to evacuate the station verbally
3. Have procedures in place to account for all employees
4. Review the emergency evacuation plan with each employee
5. Keep the plan at the station, make it available to all employees
6. Document training (mandatory)
7. Train upon hiring, then annually (or periodically)
8. Train about emergency phone numbers, emergency signage requirements, hazardous substance awareness, electrical equipment labeling requirements
9. Update and keep the Emergency Response Preparedness plan current

Class Session 3: HAZWOPER

MAJOR SPILLS

Team Assignments

Emergency Response Procedure Assignments:

Team 1 – Major Spill
Team 2 – Small Spill
Team 3 – Fire

Study your assigned procedure. Refer to the HS&E Manual if necessary.

Beprepared to role play your assigned emergency response when your team is called.

EXHIBIT 15

Jim Stamboles: This is marketing response to DSD. I'll discuss with you tomorrow unless Thanks. Mark 5/2/95

Chevron
Product Engineering

San Francisco, CA
April 27, 1995

CONFIDENTIAL

MTBE IN GROUND WATER ISSUE

MR. D.J. O'REILLY:

This memo is in response to a note you wrote on a recent memo sent to you (plus Mr. K.T. Derr and Mr. J.N. Sullivan) from Mr. R.L. Hartung regarding Methyl Tert Butyl Ether (MTBE) contamination of ground water. You asked Mr. B.D. Frolich and me if we were concerned and if any action was needed (memo attached for your convenience). This response was developed by Product Engineering in consultation with the Marketing Environmental, Health, and Safety team, the Alternative Fuels group, Public Affairs, and Chevron Research and Technology Company (CRTC).

Mr. Hartung's memo included a report by the United States Geological Survey (USGS) that summarized MTBE properties, sources, fate in the environment, and the discovery of MTBE in shallow ground water (mostly in urban areas). The USGS report did not include data regarding MTBE contamination in the deeper ground water used for drinking water, but stated that, ". . . there are few data showing concentrations of MTBE at these deeper depths." It is not clear what risk exists for MTBE transport from shallow groundwater to deeper ground water used as drinking water. The American Petroleum Institute (API) developed a response-only document in connection with the USGS report (attached). The API document quotes a regional EPA administrator as saying, "The concentrations (of MTBE) you find are substantially below anything that we would remotely consider a human health risk."

The USGS report points out that gasoline blended with MTBE may pose a greater risk to drinking water than non-oxygenated gasoline, because MTBE is soluble in water, plus it resists soil filtration and decay compared to other gasoline components. These concerns are not new, as Marketing raised the same issues ten years ago in connection with the Tank Integrity Program. Marketing does not believe that the urban shallow-ground-water MTBE contamination described in the USGS report is an urgent or significant threat to public health.

It is not yet clear what impact the MTBE-in-groundwater issue will have on the ongoing efforts of some to restrict the use of MTBE in gasoline. Although the early media interest in the USGS report has been light, connecting a potential water pollution problem to MTBE in addition to the alleged health problems may make it even more difficult for environmentalists to support MTBE.

Marketing believes that the MTBE in groundwater issue is just one more additional justification for the large Marketing capital investment in avoiding terminal and service station leaks and spills. While the USGS report will be used by anti-MTBE organizations, we do not currently expect the report to generate substantial additional interest in regulating or restricting MTBE use in gasoline in the short term.

In Mr. Hartung's memo, he mentions that ARCO announced that it is embarking on their own MTBE/groundwater test program, and that ARCO encouraged others to do independent testing on their own areas of concern. We do not recommend that Chevron begin a groundwater testing program for MTBE. The Alternative Fuels group and CRTC will take the lead roles monitoring the MTBE-in-groundwater issue, and inform you of significant future developments.

Please contact me if you have any questions.

D.C. SMITH

Attachments

cc: B.D. Frolich
R.E. Zalesky
R.M. Wilkenfeld
L.S. Shushan
J.B. Krider
F. Sam
C.L. Blackwell

Common Name : PREMIUM UNLEADED GASOLINE (CON
Manufacturer : SHELL
Revision Date : 10-07-1994
Internal ID : 10653

MATERIAL SAFETY DATA SHEET

Shell

97368 (4-85)
MSDS NUMBER 51,162-15

24-HOUR EMERGENCY ASSISTANCE
SHELL: 713-473-9461
CHEMTREC: 800-424-9300

GENERAL MSDS ASSISTANCE
SHELL: 713-241-4819

ACUTE HEALTH*	2
FIRE	4
REACTIVITY	0

HAZARD RATING
LEAST - 0
SLIGHT - 1
MODERATE - 2
HIGH - 3
EXTREME - 4

EXHIBIT
122
99128

BE SAFE
READ OUR PRODUCT SAFETY INFORMATION
... AND PASS IT ON
(PRODUCT LIABILITY LAW REQUIRES IT)

* FOR ACUTE AND CHRONIC HEALTH EFFECTS REFER TO THE DISCUSSION IN SECTION III

SECTION I - NAME

PRODUCT: PREMIUM UNLEADED GASOLINE (CONVENTIONAL AND RFG)

CHEMICAL NAME: PETROL

CHEMICAL FAMILY: HYDROCARBON

SHELL CODE: 04360 04362. 04372 04373 04375
04376 04377 04378 04380 04382

SECTION II - PRODUCT/INGREDIENTS

NO.	COMPOSITION	CAS NUMBER	PERCENT

Common Name : PREMIUM UNLEADED GASOLINE (CON
Manufacturer : SHELL
Revision Date : 10-07-1994
Internal ID : 10653

P PREMIUM UNLEADED GASOLINE
(CONVENTIONAL AND RFG) MIXTURE 100

1	ALKANES, CYCLOALKANES, ALKENES AND AROMATIC HYDROCARBONS	MIXTURE	BALANCE
2	XYLENE	1330-20-7	0-25
3	TOLUENE	108-88-3	0-25
4	BENZENE	71-43-2	0-4
5	N-HEXANE	110-54-3	0-3
6	METHYL TERTIARY-BUTYL ETHER (MTBE)	1634-04-4	0-15
7	PSEUDOCUMENE (1,2,4-TRIMETHYLBENZENE)	95-63-6	0-5
8	CYCLOHEXANE	110-82-7	0-1
9	ETHYLBENZENE	100-41-4	0-3
10	NAPHTHALENE	91-20-3	0-1
11	STYRENE	100-42-5	0-4

NOTE: CONTENT OF GASOLINE COMPONENTS WILL VARY; INDIVIDUAL COMPONENTS MAY BE PRESENT FROM TRACE AMOUNTS UP TO THE MAXIMUM SHOWN.

SHELL CODES 04364 04367 04368 04369 04388 04389 04390 04391: RFG; SHELL CODES 04383 04384 04385 04395 AND OTHERS (SEE SHELL CODE LINE ABOVE): CONVENTIONAL

NFPA HAZARD RATING: HEALTH 1 FIRE 3 REACTIVITY 0

SECTION 11 - TOXICOLOGICAL INFORMATION

ACUTE TOXICITY DATA

NO.	ACUTE ORAL LD50	ACUTE DERMAL LD50	ACUTE INHALATION LC50
P	>5 G/KG (RAT)	>2 G/KG (RABBIT)	>5 MG/L/4HR (RAT)

THE HEALTH EFFECTS NOTED BELOW ARE CONSISTENT WITH REQUIREMENTS UNDER THE OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200).

EYE CONTACT:
BASED ON PRODUCT TESTING PRODUCT IS MINIMALLY IRRITATING TO THE EYES.

SKIN CONTACT:
PROLONGED AND REPEATED LIQUID CONTACT CAN CAUSE DEFATTING AND DRYING OF THE SKIN RESULTING IN SKIN IRRITATION AND DERMATITIS.

INHALATION:
THIS PRODUCT MAY CAUSE IRRITATION TO THE NOSE, THROAT AND RESPIRATORY TRACT AND ADDITIONALLY, MAY PRODUCE LIVER AND KIDNEY DAMAGE. HIGH VAPOR CONCENTRATIONS MAY PRODUCE CNS DEPRESSION.

INGESTION:

THIS PRODUCT MAY BE HARMFUL OR FATAL IF SWALLOWED. INGESTION OF PRODUCT MAY RESULT IN VOMITING; ASPIRATION (BREATHING) OF VOMITUS INTO THE LUNGS MUST BE AVOIDED AS EVEN SMALL QUANTITIES MAY RESULT IN ASPIRATION PNEUMONITIS.

SIGNS AND SYMPTOMS:
IRRITATION AS NOTED ABOVE. EARLY TO MODERATE CNS (CENTRAL NERVOUS SYSTEM) DEPRESSION MAY BE EVIDENCED BY GIDDINESS, HEADACHE, DIZZINESS AND NAUSEA; IN EXTREME CASES, UNCONCIOUSNESS AND DEATH MAY OCCUR. ASPIRATION PNEUMONITIS MAY BE EVIDENCED BY COUGHING, LABORED BREATHING AND CYANOSIS (BLUISH SKIN); IN SEVERE CASES DEATH MAY OCCUR. KIDNEY DAMAGE MAY BE EVIDENCED BY CHANGES IN URINE OUTPUT, URINE APPEARANCE OR EDEMA (SWELLING FROM FLUID RETENTION). LIVER DAMAGE MAY BE EVIDENCED BY LOSS OF APPETITE, JAUNDICE (YELLOWISH SKIN COLOR) AND SOMETIMES PAIN IN THE UPPER ABDOMEN ON THE RIGHT SIDE.

AGGRAVATED MEDICAL CONDITIONS:
PREEXISTING EYE, SKIN, AND RESPIRATORY DISORDERS MAY BE AGGRAVATED BY EXPOSURE TO THIS PRODUCT. IMPAIRED LIVER AND KIDNEY FUNCTION(S) FROM PREEXISTING DISORDERS MAY BE AGGRAVATED BY EXPOSURE TO THIS PRODUCT.

OTHER HEALTH EFFECTS
THE INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC) HAS DETERMINED THAT GASOLINE IS POSSIBLY CARCINOGENIC TO HUMANS (GROUP 2B). IT HAS BEEN REPORTED THAT CHRONIC INHALATION EXPOSURE TO AN UNLEADED MOTOR GASOLINE. WHICH WAS FULLY VAPORIZED, HAS PRODUCED KIDNEY AND LIVER CANCERS IN SOME LABORATORY RODENTS. (SEE SECTION VI FOR FURTHER INFORMATION). THE TEST MATERIAL USED WAS BLENDED TO REPRESENT A TYPICAL UNLEADED MOTOR GASOLINE. BENZENE IS LISTED BY THE NATIONAL TOXICOLOGY PROGRAM, THE INTERNATIONAL AGENCY FOR RESEARCH ON CANCER AND OSHA AS A CHEMICAL CAUSALLY ASSOCIATED WITH CANCER (CERTAIN FORMS OF LEUKEMIA) IN HUMANS. ETHYL BENZENE HAS BEEN SHOWN TO CAUSE CANCER IN LABORATORY ANIMALS. BIRTH DEFECTS WERE NOTED IN RATS, BUT NOT RABBITS, AT DOSES WHICH CAUSED TOXIC EFFECTS IN THE MOTHERS. (SEE SECTION VI). NAPHTHALENE DID NOT CAUSE CANCER IN LIFETIME STUDIES IN RATS AND MICE CONDUCTED BY NTP. BASED UPON A RE-EVALUATION OF PREVIOUS NEGATIVE AND EQUIVOCAL DATA AND AN INCREASED INCIDENCE OF LUNG TUMORS AFTER ORAL ADMINISTRATION IN YOUNG ADULT MICE, THE INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC) HAS LISTED COMPONENT 11 (STYRENE) AMONG THOSE MATERIALS FOR WHICH THERE IS LIMITED EVIDENCE FOR CARCINOGENICITY IN ANIMALS.

SEE SECTION VI FOR SUPPLEMENTAL INFORMATION.

SECTION IV - OCCUPATIONAL EXPOSURE LIMITS

	OSHA		ACGIH		OTHER
NO.	PEL/TWA	PEL/CEILING	TLV/TWA	TLV/STEL	
P	300 PPM		300 PPM	500 PPM	500 PPM*
2	100 PPM		100 PPM	150 PPM	150 PPM*

3	100	PPM		50	PPM			150	PPM*
4	1	PPM		10	PPM**			5	PPM*
5	50	PPM		50	PPM				
8	300	PPM		300	PPM				
9	100	PPM		100	PPM	125	PPM	125	PPM*
10	10	PPM		10	PPM	15	PPM	15	PPM*
11	50	PPM		50	PPM	100	PPM	100	PPM*

*OSHA PEL/STEL. **CLASSIFIED BY ACGIH AS A "SUSPECTED HUMAN CARCINOGEN" (A2)

SECTION V - EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT:
FLUSH WITH WATER FOR 15 MINUTES WHILE HOLDING EYELIDS OPEN. GET MEDICAL ATTENTION.

SKIN CONTACT:
FLUSH WITH WATER WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. FOLLOW BY WASHING WITH SOAP AND WATER. DO NOT REUSE CLOTHING OR SHOES UNTIL CLEANED. IF IRRITATION PERSISTS, GET MEDICAL ATTENTION.

INHALATION:
REMOVE VICTIM TO FRESH AIR AND PROVIDE OXYGEN IF BREATHING IS DIFFICULT. GIVE ARTIFICIAL RESPIRATION IF NOT BREATHING. GET MEDICAL ATTENTION.

INGESTION:
DO NOT INDUCE VOMITING. IF VOMITING OCCURS SPONTANEOUSLY KEEP HEAD BELOW HIPS TO PREVENT ASPIRATION OF LIQUID INTO THE LUNGS. GET MEDICAL ATTENTION.*

NOTE TO PHYSICIAN:
*IF MORE THAN 2.0 ML PER KG HAS BEEN INGESTED AND VOMITING HAS NOT OCCURRED, EMESIS SHOULD BE INDUCED WITH MEDICAL SUPERVISION. KEEP VICTIM'S HEAD BELOW HIPS TO PREVENT ASPIRATION. IF SYMPTOMS SUCH AS LOSS OF GAG REFLEX, CONVULSIONS OR UNCONSCIOUSNESS OCCUR BEFORE EMESIS, GASTRIC LAVAGE USING A CUFFED ENDOTRACHEAL TUBE SHOULD BE CONSIDERED.

SECTION VI - SUPPLEMENTAL HEALTH INFORMATION

A CHRONIC INHALATION STUDY (REFERENCED IN SECTION III) SUPPORTED BY THE AMERICAN PETROLEUM INSTITUTE FOUND THAT FULLY VAPORIZED GASOLINE PRODUCED DOSE-RELATED INCIDENCE OF KIDNEY CANCER IN MALE RATS. IT HAS BEEN DETERMINED THAT MALE RATS DEVELOP THESE TUMORS IN A UNIQUE MANNER, VIA FORMATION OF ALPHA-2U GLOBULIN. HUMANS DO NOT FORM ALPHA-2U GLOBULIN AND THEREFORE TUMORS RESULTING FROM THIS MECHANISM ARE NOT RELEVANT TO HUMANS. GASOLINE EXPOSURE ALSO PRODUCED AN INCREASE OF LIVER CANCER AT THE HIGHEST DOSE (2056 PPM) IN FEMALE MICE. EXPOSURES WERE FOR 6 HRS/DAY, 5

DAYS/WEEK FOR A TOTAL OF 27 MONTHS. THE RELATIONSHIP AND SIGNIFICANCE TO MAN OF THE RESULTS OF THIS STUDY ARE NOT KNOWN.

INHALATION STUDIES ON GASOLINE VAPORS HAVE CAUSED CENTRAL NERVOUS SYSTEM EFFECTS IN DOGS AT 10,000 PPM. UNLEADED GASOLINE WAS EVALUATED FOR GENETIC ACTIVITY IN ASSAYS USING MICROBIAL CELLS, CULTURED MAMMALIAN CELLS AND RATS (BONE MARROW). THE RESULTS WERE ALL NEGATIVE. UNLEADED GASOLINE WAS CONSIDERED NON-MUTAGENIC UNDER THESE CONDITIONS.

INFORMATION ON GASOLINE CONSTITUENTS: XYLENE IS NOT LISTED AS A CARCINOGEN BY NTP, IARC OR OSHA AND WE ARE NOT AWARE OF DATA INDICATING IT IS MUTAGENIC, CARCINOGENIC OR A SKIN SENSITIZER. LABORATORY ANIMALS EXPOSED TO PROLONGED AND REPEATED HIGH DOSES OF XYLENE BY VARIOUS ROUTES HAVE SHOWN HEARING LOSS AND EFFECTS IN LIVER, KIDNEYS, LUNGS, SPLEEN, HEART, BLOOD AND ADRENALS; DEVELOPMENTAL TOXICITY STUDIES SHOWED EMBRYOLETHAL/TOXIC AND TERATOGENIC EFFECTS WITH MATERNAL TOXICITY. THE EFFECTS OF SOLVENTS ON HUMAN HEARING ARE UNCERTAIN. SOLVENT ABUSERS AND NOISE INTERACTION WITH XYLENE (MIXED SOLVENT) IN THE WORK ENVIRONMENT MAY CAUSE SIGNS OF HEARING LOSS.

WHILE THERE IS NO EVIDENCE THAT INDUSTRIALLY ACCEPTABLE LEVELS OF TOLUENE VAPORS (E.G., THE TLV) HAVE PRODUCED CARDIAC EFFECTS IN HUMANS, ANIMAL STUDIES HAVE SHOWN THAT INHALATION OF HIGH LEVELS OF TOLUENE PRODUCED CARDIAC SENSITIZATION. SUCH SENSITIZATION MAY CAUSE FATAL CHANGES IN HEART RHYTHMS. THIS LATTER EFFECT WAS SHOWN TO BE ENHANCED BY HYPOXIA OR THE INJECTION OF ADRENALIN-LIKE AGENTS. PROLONGED AND REPEATED EXPOSURES TO HIGH CONCENTRATIONS OF TOLUENE (MIXED SOLVENT) HAVE RESULTED IN HEARING LOSS IN LABORATORY RATS. THE EFFECTS OF SOLVENTS ON HUMAN HEARING ARE UNCERTAIN. SOLVENT ABUSERS AND NOISE INTERACTION WITH TOLUENE (MIXED SOLVENT) IN THE WORK ENVIRONMENT MAY CAUSE SIGNS OF HEARING LOSS.

TOLUENE IS NOT KNOWN TO BE MUTAGENIC OR CARCINOGENIC. HOWEVER, THE AVAILABLE HUMAN AND EXPERIMENTAL DATA ARE LIMITED AND INSUFFICIENT TO ASSESS CARCINOGENIC POTENTIAL. TOLUENE IS NOT, LISTED AS A CARCINOGEN BY NTP, IARC OR OSHA. INTENTIONAL ABUSE OF TOLUENE VAPORS HAS BEEN LINKED TO DAMAGE OF BRAIN, LIVER, KIDNEY AND TO DEATH. MANY CASE STUDIES INVOLVING ABUSE DURING PREGNANCY CLEARLY INDICATE THAT TOLUENE IS A DEVELOPMENTAL TOXICANT. DEVELOPMENTAL TOXIC EFFECTS COMPARABLE TO THOSE OBSERVED IN HUMANS HAVE BEEN SEEN IN LAB ANIMALS BUT THE EFFECTS WERE GENERALLY ASSOCIATED WITH MATERNAL TOXICITY.

ANIMAL STUDIES ON BENZENE DEMONSTRATED IMMUNOTOXICITY, TESTICULAR EFFECTS AND ALTERATIONS IN REPRODUCTIVE CYCLES, EVIDENCE OF CHROMOSOMAL DAMAGE OR OTHER CHROMOSOMAL CHANGES, AND EMBRYO/FETOTOXICITY BUT NOT TERATOGENICITY.

STUDIES ON N-HEXANE IN LABORATORY ANIMALS HAVE SHOWN MILD, TRANSITORY EFFECTS ON THE SPLEEN AND BLOOD (WHITE BLOOD CELLS), AND EVIDENCE OF LUNG DAMAGE. IN ADDITION, FETOTOXICITY HAS BEEN DEMONSTRATED AT LEVELS PRODUCING MATERNAL TOXICITY. AT HIGH LEVELS, INHALATION EXPOSURE HAS RESULTED IN TESTICULAR AND EPIDIDYMAL ATROPHY.

INHALATION OF METHYL TERTIARY-BUTYL ETHER (MTBE) VAPORS AT HIGH CONCENTRATIONS (ABOVE 4000 PPM) INDUCED CENTRAL NERVOUS SYSTEM DEPRESSION IN RATS. EXPOSURE TO MTBE VAPORS PRODUCED EMBRYO/FETOTOXICITY (INCLUDING CLEFT PALATE AT MATERNALLY TOXIC DOSES) ABOVE 4000 PPM IN MICE BUT NO DEVELOPMENTAL TOXICITY IN RABBITS AT CONCENTRATIONS UP TO 8000 PPM. MTBE WAS NOT GENOTOXIC IN SEVERAL MUTAGENICITY ASSAYS, BUT WAS POSITIVE IN A MOUSE LYMPHOMA TEST WITH METABOLIC ACTIVATION. IN A CHRONIC INHALATION STUDY, MTBE CAUSED FEMALE MOUSE LIVER TUMORS AT THE HIGH (8000 PPM) DOSE, AND MALE RAT KIDNEY TUMORS AT 3000 AND 8000 PPM; BOTH OF THESE TUMORS ARE OF QUESTIONABLE RELEVANCE TO HUMANS AND FURTHER STUDIES ARE BEING DONE TO ADDRESS THEIR SIGNIFICANCE.

CHRONIC EXPOSURE TO VAPORS OF A MIXTURE CONTAINING 50% PSEUDOCUMENE (AND POSSIBLY CONTAMINATED WITH BENZENE) CAUSED DECREASED WEIGHT GAIN AND BLOOD CHANGES (LYMPHOPENIA AND NEUTROPHILIA), LIVER, LUNG, SPLEEN, KIDNEY AND BONE MARROW EFFECTS IN RATS. PSEUDOCUMENE WAS NOT MUTAGENIC IN THE AMES TEST. REPEATED EXPOSURES OF RABBITS TO HIGH VAPOR CONCENTRATION OF CYCLOHEXANE CAUSED SLIGHT INCREASE IN BLOOD CLOTTING TIME AND MINOR MICROSCOPIC CHANGES IN LIVER AND KIDNEY. CYCLOHEXANE WAS NOT MUTAGENIC IN THE AMES TEST BUT CAUSED A DOSE-RELATED INCREASE IN SISTER CHROMATID EXCHANGE IN CULTURED HUMAN LYMPHOCYTE CELLS.

ALTHOUGH THE SIGNIFICANCE IS UNKNOWN, CHANGES IN CHROMOSOMES OF LYMPHOCYTES HAVE BEEN FOUND IN SOME STUDIES OF HUMANS EXPOSED TO COMPONENT #11. OTHER SUCH STUDIES PRODUCED NEGATIVE RESULTS. CHROMOSOMAL BREAKS HAVE BEEN REPORTED IN THE BONE MARROW CELLS OF RATS EXPOSED TO STYRENE BY INHALATION. INCREASED FREQUENCY OF SISTER CHROMATID EXCHANGE IN ALVEOLAR MACROPHAGES, BONE MARROW CELLS AND REGENERATING RAT LIVER CELLS FROM MICE EXPOSED TO STYRENE BY INHALATION HAVE ALSO BEEN REPORTED. MICROSCOPIC CHANGES IN THE LUNG, INCLUDING CONGESTION, HEMORRHAGE, EDEMA, EXUDATION, AND LEUKOCYTIC INFILTRATION WERE OBSERVED FOLLOWING ACUTE INHALATION OF COMPONENT #11 IN THE RAT AND GUINEA PIG. IN FATALLY EXPOSED ANIMALS, PULMONARY CONGESTION, EDEMA, AND NECROSIS OF THE KIDNEY AND LIVER WERE SEEN. RATS EXPOSED BY INHALATION TO 800 PPM OR GREATER OF COMPONENT #11 FOR 14 H/DAY FOR 3 WEEKS EXHIBITED HEARING DEFICITS BELIEVED TO BE SECONDARY TO HAIR CELL LOSS.

NAPHTHALENE WAS NOT MUTAGENIC IN THE AMES TEST OR MOUSE OR RAT CELL TRANSFORMATION ASSAY. THE HANDLING PROCEDURES AND SAFETY PRECAUTIONS IN THIS MSDS SHOULD BE FOLLOWED TO MINIMIZE EMPLOYEE EXPOSURE.

THE CARCINOGENIC POTENTIAL OF ETHYLBENZENE (EB) CANNOT BE ADEQUATELY EVALUATED WITH CURRENTLY AVAILABLE DATA; AN NTP STUDY IS NOW IN PROGRESS WHICH SHOULD CLARIFY THIS ISSUE. EB CAUSED LIVER AND KIDNEY EFFECTS IN RATS AT DOSES WHICH ALSO CAUSED TOXIC EFFECTS IN THE MOTHERS; EB WAS NO MUTAGENIC IN A NUMBER OF INVITRO ASSAYS.

SECTION V - PHYSICAL DATA

BOILING POINT: NOT AVAILABLE
(DEG F)

SPECIFIC GRAVITY: 0.72-0.76
(H2O=1)

VAPOR PRESSURE: 7-14.5 PSI
(MM HG) (REID)

MELTING POINT: FREEZE PT. - 72.0
(DEG F)

SOLUBILITY: NEGLIGIBLE
(IN WATER)

VAPOR DENSITY: 3.5
(AIR=1)

EVAPORATION RATE (N-BUTYL ACETATE = 1): NOT AVAILABLE

VOLATILE BY VOL= 100 (@ 415 DEG. F)

APPEARANCE AND ODOR:
BRONZE COLOR, CLEAR AND BRIGHT LIQUID. HYDROCARBON ODOR.

SECTION VI - FIRE AND EXPLOSION HAZARDS

FLASH POINT AND METHOD:
-40 DEG F TAG CLOSED TESTER

FLAMMABLE LIMITS /% VOLUME IN AIR
LOWER: 1.3 UPPER: 7.6

EXTINGUISHING MEDIA:
USE WATER FOG, FOAM, DRY CHEMICAL OR CO2. DO NOT USE A DIRECT STREAM OF WATER. PRODUCT WILL FLOAT AND CAN BE REIGNITED ON SURFACE OF WATER.

SPECIAL FIRE FIGHTING PROCEDURES AND PRECAUTIONS:
DANGER. EXTREMELY FLAMMABLE. CLEAR FIRE AREA OF UNPROTECTED PERSONNEL AND ISOLATE. DO NOT ENTER CONFINED FIRE SPACE WITHOUT FULL BUNKER GEAR INCLUDING A POSITIVE PRESSURE NIOSH APPROVED SELF-CONTAINED BREATHING APPARATUS. COOL FIRE EXPOSED CONTAINERS WITH WATER.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
VAPORS ARE HEAVIER THAN AIR ACCUMULATING IN LOW AREAS AND TRAVELING ALONG THE GROUND AWAY FROM THE HANDLING SITE. DO NOT WELD, HEAT OR DRILL ON OR NEAR CONTAINER. HOWEVER, IF EMERGENCY SITUATIONS REQUIRE DRILLING, ONLY TRAINED EMERGENCY PERSONNEL SHOULD DRILL.

SECTION VII - REACTIVITY

STABILITY: STABLE

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS AND MATERIALS TO AVOID:

AVOID HEAT, SPARKS, OPEN FLAMES AND STRONG OXIDIZING AGENTS. PREVENT VAPOR ACCUMULATION.

HAZARDOUS DECOMPOSITION PRODUCTS
CARBON MONOXIDE AND OTHER UNIDENTIFIED ORGANIC COMPOUNDS CAN BE FORMED UPON COMBUSTION.

SECTION X. EMPLOYEE PROTECTION

RESPIRATORY PROTECTION:
UNDER CONDITIONS OF POTENTIAL HIGH EXPOSURE, THE USE OF A NIOSH-APPROVED RESPIRATOR IS RECOMMENDED. PER 29 CFR 1910.134 OR 29 CFR 1910.1028 USE EITHER AN ATMOSPHERE-SUPPLYING RESPIRATOR OR AN AIR-PURIFYING RESPIRATOR FOR ORGANIC VAPORS.

PROTECTIVE CLOTHING:
AVOID CONTACT WITH EYES. WEAR CHEMICAL GOGGLES IF THERE IS LIKELIHOOD OF CONTACT WITH EYES. TEST DATA FROM PUBLISHED LITERATURE AND/OR GLOVE AND CLOTHING MANUFACTURERS INDICATE THE BEST PROTECTION IS PROVIDED BY NITRILE RUBBER, POLYVINYL ALCOHOL OR VITON/NEOPRENE.

ADDITIONAL PROTECTIVE MEASURES:
USE EXPLOSION-PROOF VENTILATION AS REQUIRED TO CONTROL VAPOR CONCENTRATIONS.

SECTION XI. ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURES:
DANGER. EXTREMELY FLAMMABLE. ELIMINATE ALL IGNITION SOURCES. HANDLING EQUIPMENT MUST BE GROUNDED TO PREVENT SPARKING. *** LARGE SPILLS *** ISOLATE THE HAZARD AREA AND DENY ENTRY TO UNNECESSARY PERSONNEL. WEAR APPROPRIATE RESPIRATOR AND PROTECTIVE CLOTHING. SHUT OFF SOURCE OF LEAK ONLY IF SAFE TO DO SO. DIKE AND CONTAIN. WATER FOG MAY BE USEFUL IN SUPPRESSING VAPOR CLOUD; CONTAIN RUN-OFF. REMOVE WITH VACUUM TRUCKS OR PUMP TO STORAGE/SALVAGE VESSELS. SOAK UP RESIDUE WITH AN ABSORBENT SUCH AS CLAY, SAND OR OTHER SUITABLE MATERIAL; PLACE IN NON-LEAKING CONTAINERS FOR PROPER DISPOSAL. FLUSH AREA WITH WATER TO REMOVE TRACE RESIDUE; DISPOSE OF FLUSH SOLUTIONS AS ABOVE. *** SMALL SPILLS *** TAKE UP WITH AN ABSORBENT MATERIAL AND PLACE IN NON-LEAKING CONTAINERS; SEAL TIGHTLY FOR PROPER DISPOSAL.

SECTION XII. SPECIAL PRECAUTIONS

DANGER. EXTREMELY FLAMMABLE. AVOID HEAT, SPARKS, OPEN FLAMES, INCLUDING PILOT LIGHTS, AND STRONG OXIDIZING AGENTS. USE EXPLOSION-PROOF VENTILATION TO PREVENT VAPOR ACCUMULATION. ALL HANDLING EQUIPMENT MUST BE GROUNDED TO PREVENT SPARKING. HARMFUL OR FATAL IF SWALLOWED. DO NOT SIPHON GASOLINE BY MOUTH.

FOR USE AS A MOTOR FUEL ONLY. DO NOT USE AS A CLEANING SOLVENT OR FOR OTHER NON-MOTOR FUEL USES. WASH WITH SOAP AND WATER BEFORE EATING, DRINKING, SMOKING OR USING TOILET FACILITIES. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.

IF A MAJOR SPILL OCCURS. GET UPWIND AND NOTIFY LOCAL EMERGENCY PERSONNEL. REMEMBER EXPLOSION AND FIRE IS THE MOST IMMEDIATE DANGER.

SECTION XIII - TRANSPORTATION REQUIREMENTS

DEPARTMENT OF TRANSPORTATION CLASSIFICATION:
CLASS 3 (FLAMMABLE LIQUID), II

THE DOT INFORMATION IN THIS SECTION IS BASED UPON AN EVALUATION OF THE PRODUCT AGAINST THE REQUIREMENTS OF 49 CFR 172 & 173 AS REVISED BY HM-181.

D.O.T. PROPER SHIPPING NAME:
GASOLINE

OTHER REQUIREMENTS:
UN 1203, GUIDE 27

SECTION XIV - OTHER REGULATORY CONTROLS

THE COMPONENTS OF THIS PRODUCT ARE LISTED ON THE EPA/TSCA INVENTORY OF CHEMICAL SUBSTANCES.

PROTECTION OF STRATOSPHERIC OZONE (PURSUANT TO SECTION 611 OF THE CLEAN AIR ACT AMENDMENTS OF 1990): PER 40 CFR PART 82, THIS PRODUCT DOES NOT CONTAIN NOR WAS IT DIRECTLY MANUFACTURED WITH ANY CLASS I OR CLASS II OZONE DEPLETING SUBSTANCES.

IN ACCORDANCE WITH SARA TITLE III, SECTION 313, THE ENVIRONMENTAL DATA SHEET (EDS) SHOULD ALWAYS BE COPIED AND SENT WITH THE MSDS.

SECTION XV - STATE REGULATORY INFORMATION

THE FOLLOWING CHEMICALS ARE SPECIFICALLY LISTED BY INDIVIDUAL STATES; OTHER PRODUCT SPECIFIC HEALTH AND SAFETY DATA IN OTHER SECTIONS OF THE MSDS MAY ALSO BE APPLICABLE FOR STATE REQUIREMENTS. FOR DETAILS ON YOUR REGULATORY REQUIREMENTS YOU SHOULD CONTACT THE APPROPRIATE AGENCY IN YOUR STATE.

STATE LISTED COMPONENT	PERCENT	STATE CODE
XYLENE (CAS NO: 1330-20-7)	0-25	NJ, MN, RI, FL, IL, PA, ME, MA, CA, CT, LA

TOLUENE (CAS NO: 108-88-3)	0-25	NJ, MN, RI, FL, IL, PA, ME, MA, CA, CT, LA, CA65
BENZENE (CAS NO: 71-43-2)	0-4	NJ, MN, RI, FL, PA, ME, MA, IL, CA, CT, LA, CA65
N-HEXANE (CAS NO: 110-54-3)	0-3	NJ, MN, RI, FL, IL, PA, ME, MA, CA, CT, LA
METHYL TERTIARY-BUTYL ETHER (MTBE) (CAS NO: 1634-04-4)	0-15	PA, CA, MA, CT, LA
PSEUDOCUMENE (1,2,4-TRIMETHYLBENZENE) (CAS NO: 95-63-6)	0-5	PA, CA, MA
CYCLOHEXANE (CAS NO: 110-82-7)	0-1	NJ, MN, RI, FL, IL, PA, ME, MA, CA, CT, LA
ETHYLBENZENE (CAS NO: 100-41-4)	0-3	NJ, RI, FL, IL, PA, ME, MA, CA, CT, LA
NAPHTHALENE (CAS NO: 91-20-3)	0-1	NJ, MN, RI, IL, PA, FL, ME, MA, CA, CT, LA
STYRENE (CAS NO: 100-42-5)	0-4	CA, CT, FL, IL, LA, MA, ME, MN, NJ, PA, RI

CA = CALIFORNIA HAZ. SUBST. LIST; CA65 = CALIFORNIA SAFE DRINKING WATER AND TOXICS ENFORCEMENT ACT LIST; CT = CONNECTICUT TOX. SUBST. LIST; FL = FLORIDA SUBST. LIST; IL = ILLINOIS TOX. SUBST. LIST; LA = LOUISIANA HAZ. SUBST. LIST; MA = MASSACHUSETTS SUBST. LIST; ME = MAINE HAZ SUBST. LIST; MN = MINNESOTA HAZ. SUBST. LIST; NJ = NEW JERSEY HAZ. SUBST. LIST; PA = PENNSYLVANIA HAZ. SUBST. LIST; RI = RHODE ISLAND HAZ. SUBST. LIST.

THIS PRODUCT CONTAINS CHEMICAL OR CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND/OR REPRODUCTIVE TOXICITY.

SECTION XVI - OTHER SPECIAL NOTES

THIS REVISION HAS CHANGES IN SECTIONS I AND II-A OF THE MSDS AND NAME/PRODUCT CODE SECTION AT THE BEGINNING OF THE EDS.

THE INFORMATION CONTAINED HEREIN IS BASED ON THE DATA AVAILABLE TO US AND IS BELIEVED TO BE CORRECT. HOWEVER, SHELL MAKES NO WARRANTY, EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF. SHELL ASSUMES NO RESPONSIBILITY FOR INJURY FROM THE USE OF THE PRODUCT DESCRIBED HEREIN.

Common Name : PREMIUM UNLEADED GASOLINE (CON
Manufacturer : SHELL
Revision Date : 10-07-1994
Internal ID : 10653

DATE PREPARED: OCTOBER 07, 1994

J. C. WILLETT

BE SAFE
READ OUR PRODUCT
SAFETY INFORMATION ... AND PASS IT ON
(PRODUCT LIABILITY LAW
REQUIRES IT)

SHELL OIL COMPANY
PRODUCT SAFETY AND COMPLIANCE
P. O. BOX 4320
HOUSTON, TX 77210

ENVIRONMENTAL DATA SHEET

Shell

EDS NUMBER 51,162-8
97449 (9-87)

PRODUCT: PREMIUM UNLEADED GASOLINE (CONVENTIONAL AND RFG)

PRODUCT CODE: 04360 04362 04372 04373 04375
04376 04377 04378 04380 04382

SECTION 1 - PRODUCT/COMPOSITION

NO.	COMPONENT	CAS NUMBER	PERCENT
P	PREMIUM UNLEADED GASOLINE (CONVENTIONAL AND RFG)	MIXTURE	100
1	ALKANES, CYCLOALKANES, ALKENES AND AROMATIC HYDROCARBONS	MIXTURE	BALANCE
2	XYLENE	1330-20-7	0-25
3	TOLUENE	108-88-3	0-25
4	BENZENE	71-43-2	0-4
5	N-HEXANE	110-54-3	0-3
6	METHYL TERTIARY-BUTYL ETHER (MTBE)	1634-04-4	0-15
7	PSEUDOCUMENE (1,2,4-TRIMETHYLBENZENE)	95-63-6	0-5
8	CYCLOHEXANE	110-82-7	0-1
9	ETHYLBENZENE	100-41-4	0-3
10	NAPHTHALENE	91-20-3	0-1
11	STYRENE	100-42-5	0-4

SHELL CODES 04364 04367 04368 04369 04388 04389 04390 04391: RFG; SHELL CODES 04383 04384 04385 04395 AND OTHERS (SEE PRODUCT CODE LINE ABOVE): CONVENTIONAL

Common Name : PREMIUM UNLEADED GASOLINE (CON
Manufacturer : SHELL
Revision Date : 10-07-1994
Internal ID : 10653

SECTION 11 SARA TITLE III INFORMATION

NO.	EHS RQ (LBS) (*1)	EHS TPQ (LBS) (*2)	SEC 313 (*3)	313 CATEGORY (*4)	311/312 CATEGORIES (*5)
P					H-1, H-2, P-3
2			YES		
3			YES		
4			YES		
6			YES		
7			YES		
8			YES		
9			YES		
10			YES		
11			YES		

FOOTNOTES

*1 = REPORTABLE QUANTITY OF EXTREMELY HAZARDOUS SUBSTANCE, SEC.302
*2 = THRESHOLD PLANNING QUANTITY, EXTREMELY HAZARDOUS SUBSTANCE. SEC 302
*3 = TOXIC CHEMICAL. SEC 313
*4 = CATEGORY AS REQUIRED BY SEC 313 (40 CFR 372.65 C), MUST BE USED ON TOXIC RELEASE INVENTORY FORM
*5 = HAZARD CATEGORY FOR SARA SEC. 311/312 REPORTING
HEALTH H-1 = IMMEDIATE (ACUTE) HEALTH HAZARD
H-2 = DELAYED (CHRONIC) HEALTH HAZARD
PHYSICAL P-3 = FIRE HAZARD
P-4 = SUDDEN RELEASE OF PRESSURE HAZARD
P-5 = REACTIVE HAZARD

SECTION 12 ENVIRONMENTAL RELEASE INFORMATION

UNDER EPA-CWA, THIS PRODUCT IS CONSIDERED AN OIL UNDER SECTION 311. SPILLS INTO OR LEADING TO SURFACE WATERS THAT CAUSE A SHEEN MUST BE REPORTED TO THE NATIONAL RESPONSE CENTER, 800-424-8802.

THIS MATERIAL IS COVERED BY CERCLA'S PETROLEUM EXCLUSION, THEREFORE, RELEASES TO AIR, LAND OR WATER ARE NOT REPORTABLE UNDER EPA-CERCLA ("SUPERFUND").

SECTION 13 RCRA INFORMATION

UNDER EPA - RCRA (40 CFR 261.21). IF THIS PRODUCT BECOMES A WASTE MATERIAL, IT WOULD BE AN IGNITABLE HAZARDOUS WASTE. HAZARDOUS WASTE NUMBER D001. REFER TO LATEST EPA OR STATE REGULATIONS REGARDING PROPER DISPOSAL.

THIS PRODUCT CONTAINS BENZENE AT >0.5 MG/L. UNDER EPA - RCRA (40 CFR

261.24), A WASTE CONTAINING THIS CHEMICAL IS HAZARDOUS (HAZARDOUS WASTE NUMBER D018) IF IT EXHIBITS THE CHARACTERISTICS OF TOXICITY AS SHOWN BY THE TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP). REFER TO THE LATEST EPA OR STATE REGULATIONS REGARDING PROPER DISPOSAL.

THE INFORMATION CONTAINED HEREIN IS BASED ON THE DATA AVAILABLE TO US AND IS BELIEVED TO BE CORRECT. HOWEVER, SHELL MAKES NO WARRANTY, EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF. SHELL ASSUMES NO RESPONSIBILITY FOR INJURY FROM THE USE OF THE PRODUCT DESCRIBED HEREIN.

DATE PREPARED: OCTOBER 07, 1994

SHELL OIL COMPANY
CORPORATE ENVIRONMENTAL AFFAIRS
P.O. BOX 4320
HOUSTON, TX 77210

FOR ADDITIONAL INFORMATION ON THIS ENVIRONMENTAL DATA PLEASE CALL
(713) 241-2252

FOR EMERGENCY ASSISTANCE PLEASE CALL
SHELL: (713) 473-9461
CHEMTREC: (800) 424-9300

PROOF OF SERVICE VIA LEXISNEXIS FILE AND SERVE

I, the undersigned, declare that I am, and was at the time of service of the paper(s) herein referred to, over the age of 18 years and not a party to this action. My business address is 1050 Fulton Avenue, Suite 100, Sacramento, CA 95825-4225.

On the date below, I served the following document on all counsel in *City of Fresno v. Chevron U.S.A., Inc., et al.*, Case No. 04 Civ 4973 (SAS), electronically through LexisNexis File & Serve:

DECLARATION OF MICHAEL AXLINE IN SUPPORT OF PLAINTIFF CITY OF FRESNO'S OPPOSITION TO CERTAIN DEFENDANTS' MOTION FOR PARTIAL SUMMARY JUDGMENT ON PLAINTIFF'S NUISANCE

I declare under penalty of perjury under the laws of the United States of America and the State of California that the foregoing is true and correct.

Executed on May 15, 2013, at Sacramento, California.

Kathy Herron

KATHY HERRON